

Nurse Practitioners, Physician Assistants and Certified Nurse Midwives' Knowledge and Behaviors regarding Periodontal Disease and its Impact on Adverse Pregnancy Outcomes

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ABSTRACT

Katherine Thomas: Nurse practitioners, Physician Assistants and Certified Nurse Midwives' knowledge and behaviors regarding periodontal disease and its impact on adverse pregnancy outcomes.

(Under the direction of Rebecca S. Wilder, RDH, MS)

The purpose of this study was to assess nurse practitioners, physician assistants, and certified nurse midwives' knowledge, behaviors and opinions regarding periodontal disease and adverse pregnancy outcomes. A 45-item survey was developed, IRB approved, pretested, and mailed to 504 North Carolina licensed nurse practitioners (NP), physician assistants (PA) and certified nurse midwives (CNM) who provide prenatal care. A total of 240 NPs, PAs and CNMs responded, achieving a response rate of 48%. Only 43% reported being trained to provide an oral exam. Many reported (62%) that their program did not address dental health in the curriculum. The majority (55%) felt their educational program was poor or very poor in education about oral health. NPs, PAs and CNMs who frequently examine women could serve an important role in screening for oral health problems and referrals. Increased education in academic programs and continuing education could prepare these professionals for collaborative care with oral healthcare professionals.

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LIST OF ABBREVIATIONS

CNM	Certified Nurse Midwife
GCF	Gingival Crevicular Fluid
IGM	Immunoglobulin
IL	Interleukin
LBW	Low Birth Weight
LPS	Lypopolysaccaride
NHANES	National Health and Nutritional Examination Survey
NP	Nurse Practitioner
OCAP	Oral Conditions and Pregnancy
PA	Physician Assistant
PPROM	Preterm Premature Rupture of Membranes
SPTB	Spontaneous Preterm Delivery
PTB	Preterm Birth
PTL	Preterm Labor
SRP	Scaling Root Planing
TNF	Tumor Necrosis Factor

INTRODUCTION

Several governmental, dental, and medical agenda's have been published that state the importance of oral health and overall well being. The first *Surgeon General's Report on Oral Health in America* was published in 2000.⁽¹⁾ The intent of the Surgeon General's report was to inform Americans about oral health and its importance to general health and well being. The report discussed the emerging associations between oral health and systemic conditions. It stated that chronic oral infections can be associated with diabetes, heart and lung diseases, stroke and preterm labor and low birth weight.⁽¹⁾ The United States Department of Health and Human Resource document , *Healthy People 2010*, outlines a plan for disease prevention and health promotion, including dental health. ⁽²⁾ A goal of *Healthy People 2010*, is to improve the health and well being of women, infants and children. Among other conditions, low birth weight and prematurity are indicated as majors concerns in the United States.⁽²⁾ The 2003 *Surgeon General's National Call to Action*, reflects the work of public and private sectors working collaboratively to achieve the goals of oral health and general health and well being of all Americans.⁽³⁾ The National Dental Hygiene Research Agenda suggested that priority should be given to the development of methods for early diagnosis and screening of oral diseases for individuals at high risk for periodontal disease.⁽⁴⁾ These documents support the need for increased awareness among health care professionals and patients about the risk factors associated with periodontal disease and other systemic conditions. The purpose of this study is to find out if there is relationship between Nurse

Practitioners, Physician Assistants and Nurse Midwives' knowledge and practice behaviors regarding periodontal disease and adverse pregnancy outcomes.

REVIEW OF THE LITERATURE

Periodontal Disease

Periodontitis affects a large segment of the population. According to the National Health and Nutrition Examination Survey III (NHANES III), over 90% of individuals over age 13 had some attachment loss. Only 15% of the population had advanced disease which was defined as 5mm or more of attachment loss. It is noted that if the definition of attachment loss were limited to 3mm or more, the prevalence of periodontitis would be 40%.⁽⁵⁾

Periodontitis is defined by the pathological detachment of collagen fibers from the cemental surfaces with the associated apical migration of the junctional epithelium onto the root surface.⁽⁶⁾ Destruction of the alveolar bone and supporting periodontal structures occur in periodontitis with loss of clinical attachment.⁽⁷⁾ Periodontitis is a chronic condition and is considered episodic in nature. The periodontal pocket serves as a reservoir for gram-negative bacteria and a source of pro-inflammatory mediators especially during periods of exacerbation.⁽⁸⁾ The most common form of periodontal disease affecting both adolescents and children is chronic periodontitis.⁽⁹⁾

The development of chronic periodontal disease is the result of a series of reactions the body exhibits to the bacteria found in dental plaque biofilm. Host cells normally present in the body such as macrophages, lymphocytes, and polymorphonuclear leukocytes (PMNs) constantly fight off microorganisms that invade the oral cavity. Host defense cells and the microbial attack are kept in balance until the microorganisms overpower the host defense.

Then, the infection and tissue damage develop causing periodontal destruction.⁽⁹⁾ Changes to the nature of the bacteria present and the virulence factors they produce may alter the balance between health and disease. This can happen through a direct effect on the tissues in the oral cavity or through the deregulation of the inflammatory response leading to the numerous changes in the effectiveness of the host defense.⁽¹⁰⁾

Periodontal Disease and Systemic Health

Research suggests that there is a possible link between oral health and systemic health.⁽¹⁰⁾ Periodontal disease may be an independent contributor to systemic conditions⁽¹¹⁾ such as the heart⁽¹²⁾⁽¹³⁾ and lung disease⁽¹⁴⁾⁽¹¹⁾⁽¹³⁾, diabetes mellitus⁽¹⁵⁾⁽¹³⁾, adverse pregnancy outcomes⁽²⁾⁽¹¹⁾⁽¹³⁾, and stroke⁽¹¹⁾. Although many studies have found a relationship between oral health and systemic conditions, the exact causal relationship has not been determined. It is hypothesized that in periodontal disease there is an increase in the bacterial load in the oral mucosa along with pro-inflammatory microbial products. Inflammatory responses that are produced locally are thought to be involved systemically if and when the body recognizes the increased activity in the periodontium.⁽¹⁰⁾ Data suggest that an individual at risk for periodontal disease has a different inflammatory trait compared to the individual at a lower risk for periodontal disease.⁽¹¹⁾ Although further research needs to be conducted in this area, it is becoming clearer that there is a connection between oral health and other systemic diseases. As the evidence mounts it will be pertinent that oral health care providers and the medical community work collaboratively to improve health in their patients.

Preterm Birth

Pre-term birth (PTB) is the leading perinatal problem in the United States.⁽¹⁸⁾ A LBW infant weighs less than 2500 grams⁽¹⁹⁾ and a preterm infant is born at less than 37 weeks of

gestation.⁽²⁰⁾ Between 1994 and 2004 there was a 14% increase in PTB, in the United States⁽²¹⁾ PTB with technological advances to improve maternal and infant care, PTB has only declined minimally.⁽²²⁾

The cost of hospitalization in the United States for PTB and LBW infants was studied using the 2001 Nationwide Inpatient Sample from the Healthcare Cost and Utilization Project.⁽²³⁾ Hospital discharge data, delivery, transfers, and readmissions for infants (< 1 year) were analyzed. In the study, the total hospital costs, which was based on weighted cost-to-charge ratios, length of stay for PTB and LBW infants, uncomplicated newborns and all other infant hospitalizations, were assessed by the degree of prematurity, complications and the expected payer. The results indicated that in 2001, 4.6 million infant hospitalizations occurred throughout the nation and 8% (384,200) were preterm or LBW infants. The total costs for preterm or LBW infants was \$5.8 billion, which was 47% of the costs for all infant hospitalizations and 27% of all pediatric hospitalizations. Each preterm or LBW infant stay in the hospital averaged \$15,100 for approximately 12.9 days. This is compared to \$600 and 1.9 days of hospitalization for uncomplicated healthy infants. Infants born extremely premature (<28 weeks) and at very low birth weight (<1000 grams) along with those infants born with specific respiratory related complication consumed an average of \$65,600 in hospitalization cost and on average were hospitalized for 42 days. Research indicates that of all PTB and LBW infant stays in the hospital, the expected payer for private/commercial insurance was 50% and 40% for Medicaid. It is concluded that PTB and LBW infant costs account for half of all infant hospitalizations and one quarter of pediatric costs in the United States. It is suggested that by preventing PTB, infant costs can be reduced dramatically.⁽²³⁾

In 2003 there were nearly half a million babies born prematurely in the United States.⁽²⁰⁾ Of all pre-term births approximately one-third result from preterm premature rupture of membranes (PPROM); another one-third because of preterm labor (PTL) (uterine contraction); and, the remaining proportion includes all other complications including induced labor from preeclampsia.⁽²⁴⁾ Implications of adverse pregnancy outcomes not only affect the infant at birth, but can contribute to life-long health issues for these infants. A few of these health issues are cerebral palsy, blindness, deafness, developmental delays, visual problems, attention deficit disorder, muscle tone disorder, neurological disorder, poor visual tracking, visual motor coordination, motor coordination, aggressiveness and poor coping skills.⁽²⁵⁾ In addition, pre-term or LBW infants are more likely to develop neuro-developmental problems compared to a full term infant.⁽²⁶⁾ Although the underlying cause of PTB and LBW is usually not evident some investigators have suggested a link to chronic periodontitis.⁽²⁾⁽¹¹⁾⁽¹³⁾

Association Between Periodontitis and Preterm Birth

The link between periodontitis, PTB may be that in the presence of periodontal disease, lipopolysaccharide (LPS) exposure, inflammatory mediators, and maternal cytokine production in the maternal serum places the patient at risk for adverse pregnancy outcomes. Targeting the placenta membrane through the bloodstream, periodontal disease serves as a reservoir for LPS.^(27, 28) Inflammatory cell mediators $\text{TNF}\alpha$ and PGE_2 that are produced locally in the oral cavity act as a potential systemic source of fetotoxic cytokines due to the high vascularity in the periodontium.⁽²⁷⁾ The increase in the inflammatory cytokines may contribute to preterm premature rupture of the membranes and uterine contraction which can lead to miscarriage or preterm delivery.⁽²⁴⁾ It is believed to be the production of maternal

cytokines, TNF α , and prostaglandins, in response to the gram-negative periodontal infection that effect the onset of labor.

Periodontal pathogens have recently been associated with other adverse pregnancy outcomes. In addition to PTB and LBW, preeclampsia is now associated with periodontal disease.⁽²⁹⁾ Preeclampsia is characterized as a rapid increase in blood pressure that affects about 5% of all pregnancies.⁽²⁹⁾ A recent study published in the *Journal of Periodontology* explores the relationship between periodontal disease and preeclampsia. The results concluded that 50% of the placentas from women with preeclampsia were positive for one or more periodontal pathogens. This was compared to only 14.3% in the control group. The study suggests that periodontal organisms may strongly associate with preeclampsia.⁽²⁹⁾

Preterm Birth Studies

Research in this area began in the early 1990's with the "Golden Hamster Model."^{(30,}
³¹⁾ In this model pregnant hamsters were challenged intravenously with gram-negative *Escherichia coli* and *Porphyromonas gingivalis*. This challenge produced a dose-dependent effect on fetal weight, malformation and fetal resorption. Additionally, *E. coli* had embryolethal effects. The data suggested that maternal exposure to *P.gingivalis* prior to and during pregnancy can induce deleterious effects on the developing fetus.⁽³⁰⁾ In another pregnant hamster model, *P. gingivalis* was placed in a subcutaneous tissue chamber to test the inflammatory mediator response and to determine pregnancy outcomes in response to this challenge. The data suggested that infections with gram-negative periodontal pathogens can elicit adverse pregnancy outcomes. Also the levels of PGE₂ and TNF α produced as a result of challenge were associated with the severity of fetal effect.⁽³¹⁾ These findings posed the

earliest question on the systemic connection between oral infections with gram-negative bacteria and the affects on pregnancy.

In 1996 a case control study of 124 women was conducted to consider if the prevalence of maternal periodontal infection could be associated with PTL and LBW, while controlling for known risk factors and covariates. ⁽²⁷⁾ Cases were considered those women who delivered a preterm or low birth weight infant and controls were those women with normal birth weight infants. Known obstetric risk factors included tobacco use, drug use, and alcohol consumption, level of prenatal care, parity, genitourinary infections and nutrition. Periodontal examinations were conducted on each subject to determine the level of clinical attachment. The study indicated that PTB and LBW cases had significantly worse periodontal disease than the normal birth weight infants. While controlling for all other risk factors and covariates the results indicated that periodontal disease is a risk factor for PTB and LBW. ⁽²⁷⁾

A pilot study was conducted to determine the relationship between periodontal inflammatory mediators and intra-amniotic mediators during normal parturition. ⁽³²⁾ Eighteen women were studied who were undergoing routine amniocentesis during early second-trimester. Periodontal examinations were performed and gingival crevicular fluid, serum and amniotic fluid were tested for PGE₂ assessment. The results concluded that gingival crevicular fluid levels of PGE₂ could be an indirect indicator of amniotic fluid PGE₂. ⁽³²⁾

Offenbacher et al conducted a study to determine if periodontal infections in pregnant women could trigger preterm labor. ⁽²⁸⁾ In this case control study forty eight subjects had gingival crevicular fluid (GCF) samples taken to measure the levels of PGE₂ and IL-1 β and to determine if these mediator levels were related to current pregnancy outcome. Four plaque

samples were obtained from each patient from the distal of each second molar before probing. Each of the four samples was placed in individual tubes for analyses using DNA probes. Plaque was taken and analyzed for 40 common periodontal pathogens. The results indicated that GCF-PGE₂ levels were significantly higher in PTB and LBW mothers compared to normal birth weight mothers. Mothers who were pregnant for the first time experienced a significant inverse association between birth weight and GCF-PGE₂ levels. This data suggested a dose-response relationship for increased GCF-PGE₂ as a marker of current periodontal disease activity and decreasing birth weight. The microbial data suggested that *Bacteriodes forsythus* (now *Tannerella forsythia*), *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans*, and *Treponema denticola* were detected in higher levels in case mothers with PTB and LBW compared to controls. The authors concluded that infection is a risk factor for PTL and LBW and that periodontal disease is a sufficient infectious challenge to cause PTL and LBW. It was recommended that large prospective studies be conducted to confirm the association between PTL and LBW and periodontal disease. Prospective studies were also suggested to determine if periodontal therapy can reduce the risk of PTL and LBW. ⁽²⁸⁾

The OCAP (Oral Conditions and Pregnancy) study was conducted over a 5 year period to determine if maternal periodontal disease contributes to the risk for prematurity and growth restriction in the presence of traditional obstetric risk factors. (33) To determine the risks, full mouth periodontal examinations were conducted at before 26 weeks gestational age and up to 48 hours after delivery. The data suggested that antepartum periodontal disease is significantly associated with a higher prevalence of PTB. The prevalence of births <28

weeks was 1.1% for mothers with healthy periodontium compared to 3.5%; for mothers with mild periodontal disease and, 11.1% for mothers with moderate-severe periodontal disease.

In addition, similar patterns were noted among mothers with LBW infants. Among periodontally healthy mothers, no babies were born with a birth weight of <1000g compared to 6.1% with mild periodontal disease and 11.4% with moderate periodontal disease. The data demonstrates a “dose-response” relationship between increasing periodontal severity and increasing prematurity as well as LBW. The investigators suggested that periodontal disease is a risk factor for adverse pregnancy outcomes and is as important as other known risk factors such as smoking, alcohol and genitourinary tract infections. ⁽³³⁾

To study the relationship between fetal inflammatory and immune responses to oral pathogens and risk for PTB a prospective observational study was conducted by Boggess et al. ⁽³⁴⁾ Enzyme-linked immunosorbent was used to determine C-reactive protein, interleukin (IL)-1 β , IL-6, tumor necrosis factor (TNF)- α , Prostaglandin E2, and 8-isoprostane in the serum level of 640 umbilical cord blood specimens. The presence of fetal immunoglobulin M (IgM) antibody against oral pathogens was determined and the detection of >1 oral pathogen specific antibody was categorized positive. The results indicated that out of 640 births, forty eight 7.5% delivered preterm. PTB were higher if categorized as high versus low 8-isoprostane or TNF- α (23 vs 5%) and (10 vs 4%). The rate of PTB was also higher if categorized as IgM positive versus negative (10.6% vs 5.8%). According to this study the joint effects of fetal IgM seropositively, detectable C-reactive protein, or high 8-isoprostane, PGE₂ or TNF- α resulted in a significantly increased risk for PTB. Fetal exposure to oral pathogens evidenced by IgM response was associated with PTB. In addition, the risk for PTB is greatest among fetuses that also demonstrate an inflammatory response. ⁽³⁴⁾

Another prospective study was conducted by Boggess et al to determine if periodontal disease is associated with the delivery of a small –for- gestational -age infant. ⁽³⁵⁾ Periodontal disease was categorized as healthy, mild, moderate or severe and small for gestational age was defined as less than the 10th percentile for gestational age. The results indicated that out of 1017 woman, sixty seven (6.6%) delivered a small for gestational age infant and one hundred forty three (14.3%) of the woman had moderate or severe periodontal disease. The small for gestational age infant rate was higher among women with moderate to severe periodontal disease, compared to those with healthy or mild periodontal disease. The authors concluded that women who are pregnant and have severe or mild periodontal disease early in pregnancy are at greatest risk to deliver a small for gestational age infant. ⁽³⁵⁾

The OCAP study by Offenbacher was conducted to estimate if periodontal disease was predictive of preterm birth which is less than 37 weeks or very PTB less than 32 weeks. The OCAP study was conducted on 1,020 pregnant women whom received examinations both before and after delivery. To estimate whether maternal exposure to either periodontal disease at enrollment (less than 26 weeks) or periodontal disease progression during pregnancy, periodontal status before and after delivery was compared and was predictive of PTB and very low PTB. Risk factors that were adjusted for were previous PTB, race, smoking, social domain variables, and other infections. The results showed that PTB was present among 11.2% periodontal healthy women and 28.6% women with moderate-severe periodontitis. Periodontal status before delivery was associated with an increased incidence of spontaneous PTB 15.2% verses 24.9%. PTB was 6.4% among women with periodontal disease progression compared to 1.8% of woman with out disease progression. As demonstrated in the OCAP study, maternal periodontal disease increases relative risk for

preterm or spontaneous PTB. With this, independently of traditional risk factors, periodontal disease progression during pregnancy was a predictor of the more severe adverse pregnancy outcomes of PTB. ⁽³⁶⁾ As a secondary analysis of data that had been collected on the previous OCAP study, maternal factors that potentially were associated with fetal exposure to oral pathogens were examined along with the role of vaginal bleeding and fetal exposure to oral pathogens in PTB. The data were complete for 661 women, two hundred and thirty 34.8% with fetal exposure to oral pathogens and four hundred thirty one 65.2% without fetal exposure to oral pathogens. The results indicated that after the adjusted ratio for women with PTB and first or second-trimester bleeding along with fetal exposure to oral pathogens was 95%. Increasing the risk for PTB, vaginal bleeding is associated with fetal exposure to oral pathogens. The investigators concluded that further research needs to be conducted in whether vaginal bleeding is the cause of or a result of fetal exposure to oral pathogens. ⁽³⁷⁾

A pilot intervention study was conducted to determine if the treatment of periodontitis reduces the risk of PTB. ⁽³⁸⁾ Three hundred sixty-six pregnant women between 21 and 25 weeks of gestation were randomized to one of three stratified treatment groups PTB. The treatment groups consisted of 1) a dental prophylaxis plus placebo capsule, 2) scaling and root planing (SRP) plus placebo capsule; and 3) SRP plus metronidazole capsule (250mg t.i.d) for one week. In addition 723 pregnant women whom met the same periodontal criteria, were enrolled in a prospective study and served as an untreated reference group. The results indicated that the rate of PTB at <35 weeks was 4.9% in the prophylaxis group, compared to 3.3% in the SRP plus metronidazole group and 0.8% in the SRP plus placebo group (p=0.75 and 0.12 respectively). When compared to the reference group the rate of PTB <35 weeks was 6.3%. In this particular population, performing SRP in pregnant women may reduce preterm

delivery. However, metronidazole therapy did not improve pregnancy outcomes. The authors indicate that larger trials will be needed to achieve statistical significance. ⁽³⁸⁾

To evaluate the effects of second-trimester SRP and the use of a sonic toothbrush on the rate of PTB <37 weeks of gestation, Offenbacher et al conducted a randomized, delayed treatment, controlled pilot trial. Secondary outcome measures included were periodontal status, effects of therapy on the levels of oral inflammatory mediators, the levels of bacterial pathogens within the plaque, and the serum inflammatory response. The results indicate that treatment improved periodontal health, was safe and prevented periodontal disease progression. Preliminary data showed a 3.8-fold reduction in the rate of preterm delivery, a decrease in periodontal pathogen load, and a decrease in both GCF IL-1 β and serum markers of IL-6. Further studies are needed to substantiate early findings. ⁽³⁹⁾

Gazolla et al conducted a randomized clinical trial to determine if periodontal treatment on pregnant women with periodontal disease affected the weight or delivery of the newborn. ⁽⁴⁰⁾ Four hundred and fifty pregnant women who were receiving prenatal care in Tres Coracoes, Brazil were enrolled. . One hundred twenty-two pregnant women were labeled as healthy and without periodontal disease. Three hundred twenty eight were labeled as “sick” and having periodontal disease. After 62 “sick” patients dropped out of the study, the “sick” group was divided into two groups, the “treated sick” which had 266 pregnant women with periodontal disease and the, “non-treated sick” with 62 pregnant women with periodontal disease that dropped out of the study. During the first trimester of pregnancy, all participants were provided oral hygiene instructions, a toothbrush, toothpaste and dental floss at each visit. Periodontal treatment was performed during the second trimester of pregnancy. Periodontal treatment involved dental prophylaxis, supragingival and subgingival SRP. After

periodontal treatment was conducted, patients were instructed to use 0.12% Chlorhexidine mouth rinse twice daily with their regular oral hygiene regimen. During the third trimester an evaluation was conducted. Success was measured by probing depth decrease and no bleeding. All 388 subjects were visited at their homes after giving birth to record the duration of pregnancy and the weight of the newborn infant. The “non-treated sick” groups weight and duration of pregnancy was retrieved from the Public Health Office in Tres Coracoes. The results indicated that there was no statistical difference between the healthy subjects and the subjects that were treated for periodontal disease. However, the results show that the prevalence of preterm LBW for the “non-treated sick” group was 79% higher when compared to the other groups. Along with this, education level, previous PTB and periodontal disease were significantly related to PTB ($P > 0.001$). It was concluded that periodontal disease is significantly related to preterm LBW and that periodontal treatment during pregnancy should be included in prenatal care programs. ⁽⁴⁰⁾

Studies That Found No Relationship Between Periodontal Disease and Preterm Birth

Michalowicz et al conducted a large investigation to determine if nonsurgical periodontal treatment in pregnant women reduced the risk of delivery before 37 weeks and resulted in a greater birth weight and a reduced proportion of infants who were small for gestational age. Women were assigned randomly to undergo SRP before 21 weeks gestation or after delivery. The patients in the treatment group received SRP and also underwent monthly tooth polishing and oral hygiene instructions. Control patients received only a brief oral examination at monthly follow ups. After delivery the control group was offered the same periodontal therapy. Patients were monitored for oral adverse events such as the progression of periodontitis. Treatment for patients with progressing periodontal disease was

not delayed in the control or treatment group unless treatment was contraindicated. PTB occurred in 49 of 407 women in the treatment group and in 52 of the women in the control group. Although periodontal treatment improved periodontitis measures, it did not significantly alter the risk of PTB. It was concluded that although the treatment of periodontal disease in pregnant women is safe and improves periodontal disease, it does not alter the rates of PTB, LBW or fetal growth restriction. One reason for such results may be due to the fact that treatment was rendered too late into the pregnancy. Additional studies are recommended to determine if periodontal treatment provided earlier in pregnancy or before conception will improve adverse pregnancy outcomes. ⁽⁴¹⁾

To test the relationship between periodontal disease in women and PTB and LBW, a population based, cross-sectional study was conducted in Brazil. ⁽⁴²⁾ Three specific outcomes were examined: LBW, prematurity, and prematurity and/or low birth weight. Four hundred forty nine pregnant women were interviewed and examined up to 48 hours post-partum. Periodontal examinations were conducted on all teeth using calibrated periodontal probes. Maternal health and habits were measured in a questionnaire after the periodontal examination. The depths of gingival sulci were measured and bleeding on probing was observed. The results reported that periodontal pockets were not associated with LBW and or PTB. However, an association was found between prematurity and periodontal pockets, but it was confounded by maternal health variables. ⁽⁴²⁾

A population-based, case control study was conducted to establish whether patterns of periodontal care especially cessation of periodontal care during pregnancy was associated with an increased risk of LBW babies. ⁽⁴³⁾ Seven hundred ninety three cases were defined with infants weighing <2,500g and a random sample of 3,172 controls with infants >2,500.

The case control population base was selected consisting of all women who had known eligibility for dental insurance both prior to and during pregnancy between 1993 and 2000. The case group consisted of all pregnancies between 1993 and 2000 resulting in LBW infants. The patterns of periodontal care were established based on the presence or absence of SRP or periodontal maintenance prior to and during pregnancy. Four patterns of periodontal care were defined: no periodontal care; cessation of periodontal care during pregnancy; periodontal care prior to and during pregnancy; and, periodontal care during pregnancy only. The results found that periodontal care utilization was associated with at 2.35-fold increased odds of self-reported smoking during pregnancy, a 2.19-fold increased odds for diabetes, and a 3.90-fold increased odds for black race and higher maternal age. After these factors were adjusted the interruption of periodontal care during pregnancy did not lead to an increased risk for LBW infant when compared to women with no history of periodontal care. Women who received periodontal care had genetic and environmental characteristics, such as smoking, diabetes, and race that were associated with an increased risk for LBW infants. In this study periodontal care patterns alone were unrelated to LBW infants.⁽⁴³⁾

To measure the association of maternal periodontitis with LBW, PTB, and intra-uterine growth restriction, Bassani et al conducted a case- control study.⁽⁴⁴⁾ Subjects were examined and periodontitis was evaluated through attachment loss. Other data collected included perinatal outcomes and general health information. . Three hundred and four cases along with 611 controls had similar prevalence and severity of periodontitis. This was defined as at least 3 sites in different teeth, with clinical attachment loss of >3mm. Several factors were associated with the outcome, but the crude odds ratio for periodontitis was not significant. Odds ratio was 0.93 for LBW and 0.92 for PTB in the presence of periodontitis,

after adjusting for maternal age, previous pregnancies, pre-natal care, smoking, previous low birth or premature birth and other medical conditions. The results indicate that adverse pregnancy outcomes are better explained by determinates other than periodontal health. The association of periodontitis and PTB and LBW infants should be further studied especially in instances of severe periodontitis.⁽⁴⁴⁾

Insurance Companies and the Oral-Systemic Link

As studies and research emerge insurance companies are becoming more aware of the strong relationship between poor oral health and certain systemic conditions. Preventative treatment in the dental office could prevent a systemic condition which in turn allows individuals to save on medical expenses. Some insurance companies are adding enhanced benefits to dental plans that target at high-risk populations. For example Aetna Inc.⁽⁴⁵⁾ is adding free additional SRP and periodontal maintenance for pregnant women, heart disease and patients with diabetes. Cigna Corp.⁽⁴⁵⁾ is including full coverage for SRP and periodontal maintenance for pregnant women, patients with diabetes and heart disease. In addition to this Cigna is also offering an extra regular prophylaxis to pregnant patients. The enhanced benefits are being favored by big companies who have to cut medical costs. According to the *Colgate Oral Care Report*, when insurance nurses were allowed to call employees with conditions such as diabetes, heart disease or pregnant women and invite them to see a dentist, 36% of 2,200 accepted the invitation. Not only are insurance companies offering preventative benefits, some insurance companies are now covering advanced treatment for missing or damaged teeth, such as implants, bridges, and composite fillings.⁽⁴⁵⁾ Having agreement with the insurance companies and the medical community is one of the first steps to improving oral health and educating patients on the oral systemic link.

The type of dental insurance that a patient has regardless if it is private or government funded is a central predictor of dental care utilization. ⁽⁴⁶⁾ In today's society individuals insured by the government are faced with higher incidences of oral diseases and less access to care. In the United States on average, one third of all births are covered by Medicaid. ⁽⁴⁶⁾ The eligibility of dental care in adults can vary widely from partial dental coverage to no dental coverage at all in certain states. Today there are 7 jurisdictions providing comprehensive care to eligible adults. ⁽⁴⁶⁾ However, in 8 states in the U.S, women who are pregnant and covered by Medicaid have no dental benefits. ⁽⁴⁶⁾ The relief of pain or dental infection is covered in 18 states along with the eligibility for a limited range of services in 18 states. However, in trying to reduce adverse pregnancy outcomes in women, Utah, California and Louisiana have expanded benefits specifically for expectant women. ⁽⁴⁶⁾ Boggess et al suggest that during the 9 months of gestation may be the only time that low income pregnant women can obtain dental coverage due to the fact that many states only provide adult dental coverage or enhanced benefits to women during pregnancy. ⁽⁴⁶⁾

Pregnant Women's Knowledge and Behaviors Regarding Oral Health

Oral health during pregnancy plays an important role in the health of infants. Studies suggest that adverse pregnancy outcomes are linked to the mother's oral health status. ⁽²⁾⁽¹¹⁾⁽¹³⁾ To increase awareness regarding the oral-systemic link, health care providers must collaborate to educate pregnant patients before and during pregnancy. The Center for Disease Control and Prevention (CDC), Division of Oral Health attempted to look at women's knowledge and attitudes regarding oral health and dental visits during pregnancy. Data was used from the CDC Pregnancy Risk Assessment Monitoring System (PRAMS) which surveys women's attitudes, experiences, and behaviors before, during and after pregnancy.

The finding indicated that most women did not visit the dentist during pregnancy, and those who reported having oral problems, one-half did not seek care. The qualitative results show that many pregnant women believe that poor oral health is normal during pregnancy and that some dental procedures could harm the unborn child. In conclusion, oral health needs and behaviors of pregnant women need more attention from researchers and health program planners to educate women about the importance of oral health during pregnancy. ⁽⁴⁷⁾

Habashneh et al conducted a study to investigate factors related to the utilization of dental care rendered during pregnancy along with assessing mothers' knowledge regarding oral health during pregnancy and its affect on pregnancy outcomes. Six hundred twenty five mothers who gave birth from August 2001 to March 2002 in Johnson County, Iowa were mailed a survey. The survey assessed knowledge, behaviors, and attitudes toward dental care during pregnancy along with personal, demographic and pregnancy-related factors. The results reported that out of a response rate of 69%, only 49% reported visiting the dentist while pregnant. Being aware of the connection between oral health and adverse pregnancy outcomes was reported by 43%. Factors that were associated with reporting dental visits during gestation were personal factors such as marriage status, greater frequency of dental visits when not pregnant and the use of inter-proximal aids. Also financial factors such as dental insurance and knowing the possible connection between oral health and adverse pregnancy outcomes were also associated with dental visits during pregnancy. It was concluded that out of a high socioeconomic status standing group of women, the knowledge of the relationship between oral health and adverse pregnancy outcomes was limited. It is suggested that oral health education is vital to women before and during pregnancy to bring greater attention to the importance of oral health and adverse pregnancy outcomes. ⁽⁴⁸⁾

In order to promote oral health in patients during gestation all health care professionals that are involved in the care of the patient must be involved. Dentists, dental hygienists, physicians, and nurses must join forces to provide oral health exams, refer patients as needed and educate about the oral-systemic link and its possible relationship to adverse pregnancy outcomes. ⁽²⁾⁽¹¹⁾⁽¹³⁾

Physicians' Knowledge and Behaviors Regarding Oral Health

Physicians are in the position to prevent oral disease but they may lack the knowledge and skill to do so. Lewis et al conducted a national survey of 1,600 pediatricians and found that ninety percent felt that they had an important role in identifying dental problems and teaching prevention to families. However, only half of the physicians reported that they had training in medical school or residency regarding dental issues. In addition only 9% answered correctly in the knowledge section of their survey on oral health questions. ⁽⁴⁹⁾ McCundiff et al showed that only 7% of primary care physicians performed an oropharyngeal cancer examination on patients and that their knowledge level needed to be more current. ⁽⁵⁰⁾

Wilder et al conducted a study with 194 practicing obstetricians in a five county area in central North Carolina. ⁽⁵¹⁾ Of the 138 eligible physicians, 55 responded yielding a 40% response rate. Of the respondents 95% correctly identified the description of gingivitis where only 67% knew the correct description of periodontitis. When asked about what causes periodontal disease or what is associated with periodontal disease, 94% answered correctly with bacteria although many answered tooth decay 73%, aging 69% and excess dietary sugar 51%. Eighty percent knew that periodontitis was more serious than gingivitis. Twenty two percent looked into patients' mouths at initial prenatal examination, 9% periodically, and 48% only when a problem was mentioned by the patient. Forty nine percent rarely or never

recommended a dental examination. Most, 84%, considered periodontal disease to be as important a risk factor to adverse pregnancy events as those currently known in obstetrics practice. This study suggested that there is limited incorporation of dental care in medical settings.⁽⁵¹⁾

The University of Washington (UW) medical school has conducted extensive research on the lack of knowledge on oral health and how it relates systemically to overall health.^(52, 53) Investigators at UW estimated that medical students received about two hours of lecture on oral health during their four years of medical school. In 2005, a new oral health elective was created at the UW medical school to provide students the opportunity to learn more about oral health. The goal of the curriculum was to provide medical students with the knowledge, attitude and skills to graduate and provide preventative dental care. Knowledge objectives incorporated into the curriculum included public health, pathogenesis of the most common oral diseases, caries, periodontal disease and oral cancer. The behavioral aspects of oral health such as oral cancer risk, diet and prevalence of caries, oral hygiene and periodontal disease, and periodontal disease and systemic health. Attitudinal objectives included the awareness that oral health is important to overall health, physicians have a role in preventing oral disease and identifying it early and the importance of collaboration between dentists and physicians. The lectures were taught by nine pairs of medical and dental faculty. After each lecture there was a clinical laboratory or an interview with a patient to enable the medical students to get practical experience. Dental students served as volunteers during the laboratory exercises, and they assisted the medical students during the performance of oral exams and the application of fluoride varnish. Thirty medical students were enrolled in the elective. The results of the pre and posttest of oral health attitudes,

confidence and knowledge were that the students' attitudes toward oral health were more positive at the completion of the course, and their confidence in identifying oral disease was higher ($p < .001$). The greatest attitudinal shift was observed on several items of the pre-survey and post-survey as follows: including the importance of discussing the patient's oral health issues with their dentist and the importance of educating patients about tooth brushing and flossing. Student's confidence levels increased most in their ability to recognize dental decay in a patient. Students' overall knowledge score improved ($p < .001$), with increases in their scores on items assessing caries ($p < .001$) as well as oral-systemic issues ($p < .001$). There was no change in knowledge level in public health issues and some misconceptions still existed on several basic facts such as numbers of primary teeth in children. This course has now become a permanent elective for medical students after a great deal of positive feedback. ^(52, 53)

Nurses' Knowledge and Behaviors Regarding Oral Health

Nurses are extremely important to the care of patients in all aspects of their health. They are in an ideal position to be a health care provider to screen, refer and promote periodontal health. Many times barriers such as inadequate knowledge and skills towards oral health prevent oral health promotion. One hundred fifty eight primary care nursing centers were surveyed in the United States to determine to what extent they provide oral health screening, education, and referral services for clients. Participants were also surveyed regarding identifying factors that discourage and encourage these services. ⁽⁵⁴⁾The investigators reported that nearly half of the responding nurses at primary care nursing centers "almost always" screen clients for gum infections (49%), and oral lesions (48%). Fewer nurses teach their clients how to perform oral cancer self-examinations 20%; the

effects of xerostomia 19% and the benefits of fluoride 38%. The majority reported not always referring clients for dental decay 55%, gum infections 61%, missing teeth 80%, oral lesions 67%, oral pain 64%, or oral trauma 65%. Factors that discouraged referrals were lack of referral sources 64% and unavailability of health care professionals to provide on site basic oral health services in the centers 63%. Factors that encouraged the integration of oral health services into primary care nursing centers were an appreciation for the benefits of oral health 73% and a knowledgeable clinician to perform oral health services 68%. This data provides support for the collaboration of dental hygienists and nurses to expand oral health services. ⁽⁵⁴⁾

A study was conducted to assess nurses' knowledge and education in relation to oral care and oral health assessment for patients undergoing cancer treatment. A non-random sample of one hundred nurses was surveyed. The participants were general nurses or oncology nurses. Forty six percent had received both theoretical and clinical education in oral care during their general nurse education. However, only 10% reported having a lot of education in oral care, while 43.1% had received no education in oral care on cytotoxic drugs or radiation treatment during general nurse education. Theoretical and clinical education in oral care during oncology nurse education was reported by 63%. Only 7% of cancer nurses reported receiving a great deal of education in oral care during oncology nurse education. In the previous year only 11% of general nurses and 19% of cancer nurses reported attending continuing education in oral care. However, 94% of oncology nurses indicated the need for continuing education on oral health. These findings suggest that substantial oral health education is lacking in nursing schools. ⁽⁵⁵⁾

Primary care providers such as family physicians, pediatricians, registered nurses, physician assistants, and nurse practitioners could play an important role in preventative services. These services include care to very young children and those individuals with limited access to dental care. A search was conducted using Cochrane Library and MEDLINE to locate systematic reviews published between January 1988 and March 2003. The search was conducted on the topic of the roles that primary care providers play an important role in preventative services efficacy of continuing medical education, printed educational materials, academic outreach, reminders and local opinion leaders on the adoption of new knowledge and practices by primary care providers, Eleven systematic reviews were used. The results indicate that formal continuing medical education (CME) and distributing educational materials did not effectively change primary care providers' behaviors. It was found that there are effective interventions available to increase knowledge and change behaviors such as small group discussion, interactive workshops, educational outreach visits and reminders. There is limited research on the topic regarding primary health care providers improving oral care, the authors suggest further investigation. ⁽⁵⁶⁾

Nurse Practitioners and Oral Health Knowledge

A nurse practitioner (NP) is a nurse with a post master's degree focused in areas , such as family, adult, pediatric or women's health care. NP's gain advanced comprehensive assessment and diagnostic reasoning skills and knowledge and skill in management of health problems. ⁽⁵⁷⁾

When caring for pregnant women nurses have numerous duties. Often times the health of the maternal and fetal oral cavity is overlooked.⁽⁵⁸⁾ Nurses working in prenatal clinics are in perfect positions to implement and direct educational programs for expectant

mothers. ⁽⁵⁹⁾ Many times, NPs, PAs and CNMs are the individuals implementing screenings, referrals and the promotion of oral health in pregnant women.

There is a lack of studies that investigate nurses' periodontal knowledge. Most of our population is affected by periodontal disease and current research continues to mount on the oral systemic link between periodontal disease and systemic conditions such as PTB and LBW. Nurses and NP's are in a critical role to promote oral health. The purpose of this study is to determine NPs, PAs and CNMs knowledge, behaviors and opinions regarding periodontal disease and adverse pregnancy outcomes.

Purpose for Project

The purpose of this study was to investigate NPs, PAs and CNMs knowledge, behaviors and opinions regarding periodontal disease and adverse pregnancy outcomes.

INTRODUCTION AND REVIEW OF THE LITERATURE

Several governmental, dental, and medical agenda's have been published that state the importance of oral health and overall well being. The first *Surgeon General's Report on Oral Health in America* was published in 2000.⁽¹⁾ The intent of the Surgeon General's report was to inform Americans about oral health and its importance to general health and well being. The report discussed the emerging associations between oral health and systemic conditions. It stated that chronic oral infections can be associated with diabetes, heart and lung diseases, stroke and preterm labor (PTL) and low birth weight (LBW).⁽¹⁾ The United States Department of Health and Human Resource document, *Healthy People 2010*, outlines a plan for disease prevention and health promotion, including dental health.⁽²⁾ A goal of *Healthy People 2010*, is to improve the health and well being of women, infants and children. Among other conditions, LBW and prematurity are indicated as majors concerns in the United States.⁽²⁾ The *Surgeon General's National Call to Action in 2003*, reflects the work of public and private sectors working collaboratively to achieve the goals of oral health and general health and well being of all Americans.⁽³⁾ These documents support the need for increased awareness among health care professionals and patients about the risk factors associated with periodontal disease and other systemic conditions.

Periodontal Disease

Periodontitis is defined by the pathological detachment of collagen fibers from the cemental surfaces with the associated apical migration of the apical part of the junctional epithelium onto the root surface.⁽⁶⁾ Destruction of the alveolar bone and supporting structure

occur in periodontitis with loss of clinical attachment.⁽⁷⁾ Periodontitis is a chronic condition and is considered episodic in nature. The periodontal pocket serves as a reservoir for gram-negative bacteria and a source of pro-inflammatory mediators especially during periods of exacerbation.⁽⁸⁾

Periodontal Disease and Systemic Health

Research suggests that there is a possible link between oral health and systemic health.⁽¹⁰⁾ Periodontal disease may be an independent contributor to systemic conditions⁽¹¹⁾ such as the heart⁽¹²⁾⁽¹³⁾ and lung disease⁽¹⁴⁾⁽¹¹⁾⁽¹³⁾, diabetes mellitus⁽¹⁵⁾⁽¹³⁾, adverse pregnancy outcomes⁽²⁾⁽¹¹⁾⁽¹³⁾, and stroke⁽¹¹⁾⁽³⁾⁽¹⁶⁾⁽¹⁷⁾. Although many studies have found a relationship between oral health and systemic conditions, the exact causal relationship has not been determined. It is hypothesized that in periodontal disease there is an increase in the bacteria load in the oral mucosa along with pro-inflammatory microbial products. Inflammatory responses that are produced locally are thought to be involved systemically if and when the body recognizes the increased activity in the periodontium.⁽¹⁰⁾ Data suggest that an individual at risk for periodontal disease has a different inflammatory trait compared to the individual at a lower risk for periodontal disease.⁽¹¹⁾ Although further research needs to be conducted in this area, it is becoming clearer that there is a connection between oral health and other systemic diseases. As the evidence mounts it will be pertinent that oral health care providers and the medical community work collaboratively to improve health in their patients.

Preterm Birth

PTB is the leading perinatal problem in the United States.⁽¹⁸⁾ A low birth weight infant weighs less than 2500 grams⁽¹⁹⁾ and is born less than 37 weeks of gestation.⁽²⁰⁾ With

advances in technology to improve maternal and infant care, PTB and LBW has only declined minimally.⁽²²⁾

The cost of hospitalization in the United States for PTB and LBW infants was studied using the 2001 Nationwide Inpatient Sample from the Healthcare Cost and Utilization Project.⁽²³⁾ Hospital discharge data, delivery, transfers, and readmissions for infants (< 1 year) were analyzed. In the study, the total hospital costs, which was based on weighted cost-to-charge ratios, length of stay for PTB and LBW infants, uncomplicated newborns and all other infant hospitalizations, were assessed by the degree of prematurity, complications and the expected payer. The results indicated that in 2001, 4.6 million infant hospitalizations occurred throughout the nation and 8% (384,200) were preterm or LBW infants. The total costs for preterm or LBW infants was \$5.8 billion, which was 47% of the costs for all infant hospitalizations and 27% of all pediatric hospitalizations. Each preterm/ LBW individual infant stay in the hospital averaged \$15,100 for approximately 12.9 days this is compared to \$600 and 1.9 days of hospitalization for uncomplicated healthy infants. Extremely preterm infants (<28 weeks' gestation/birth weight <1000g) and specific respiratory-related complications hospitalizations costs for approximately 42 days were the highest averaging \$65,600. Research indicates that of all PTB and LBW infant stays in the hospital, the expected payer for private/commercial insurance was 50% and 40% for Medicaid. It is concluded that PTB and LBW infant costs account for half of all infant hospitalizations and one quarter of pediatric costs in the United States. It is suggested that by preventing PTB, infant costs can be reduced dramatically.⁽²³⁾

Implications of adverse pregnancy outcomes not only affect the infant at birth, but greater health problems can occur throughout the lives of these individuals. Of all PTB

approximately one-third result from preterm premature rupture of membranes (PROM); another one-third because of PTL (uterine contraction); and, the remaining proportion includes all other complications including induced labor from preclampsia is a major indication.⁽²⁴⁾ Several of these potential impairments occurring after birth are cerebral palsy, blindness, deafness, developmental delays, visual problems, attention deficit disorder, muscle tone disorder, neurological disorder, poor visual tracking, visual motor coordination, motor coordination, aggressiveness and poor coping skills.⁽²⁵⁾ In addition, pre-term or LBW infants are more likely to develop neuro-developmental problems compared to a full term infant.⁽²⁶⁾ Although the underlying cause of PTB and LBW is usually not evident some investigators have suggested a link to chronic periodontitis.⁽²⁾⁽¹¹⁾⁽¹³⁾

Association Between Periodontitis and Preterm Birth

The link between periodontitis, PTB and LBW may be that in the presence of periodontal disease, lipopolysaccharide (LPS) exposure, inflammatory mediators, and maternal cytokine production in the maternal serum places the patient at risk for adverse pregnancy outcomes. Targeting the placenta membrane through the bloodstream, periodontal disease serves as a reservoir for LPS.^(27, 28) Inflammatory cell mediators TNF α and PGE₂ that are produced locally in the oral cavity act as a potential systemic source of fetotoxic cytokines due to the high vascularity in the periodontium.⁽²⁷⁾ The increase in the inflammatory cytokines may contribute to preterm rupture of the membranes and uterine contraction which can lead to miscarriage or preterm delivery.⁽²⁴⁾ As outlined above the production of maternal cytokines, TNF α , and prostaglandins in response to the gram-negative periodontal infection affect the onset of labor.

Periodontal pathogens have recently been associated with other adverse pregnancy outcomes. In addition to PTB, preeclampsia is now associated with periodontal disease.

⁽²⁹⁾Preeclampsia is characterized as a rapid increase in blood pressure that affects about 5% of pregnancies. ⁽²⁹⁾ A recent study published in the *Journal of Periodontology* explores the relationship between periodontal disease and preeclampsia. The results concluded that 50% of the placentas from women with preeclampsia were positive for one or more periodontal pathogens. This was compared to only 14.3% in the control group. The study suggests that periodontal organisms may be associated with preeclampsia. ⁽²⁹⁾

Offenbacher et al conducted a study to determine if periodontal infections in pregnant women could trigger PTL. ⁽²⁸⁾ Four plaque samples were obtained from each patient from the distal of each second molar before probing. Each of the four samples was placed in individual tubes for analyses using DNA probes. Plaque was taken and analyzed for 40 common periodontal pathogens. Four periodontal pathogen levels were measured using microbe-specific probes. The results indicated that GCF-PGE₂ levels were significantly higher in PTB and LBW mothers compared to normal birth weight mothers. Mothers who were pregnant for the first time experienced a significant inverse association between birth weight and GCF-PGE₂ levels. This data suggested a dose-response relationship for increased GCF-PGE₂ as a marker of current periodontal disease activity and decreasing birth weight. The microbial data suggested that *Bacteriodes forsythus* (now *Tannerella forsythia*), *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans*, and *Treponema denticola* were detected in higher levels in case mothers with PTB and LBW compared to controls. The authors concluded that infection is a risk factor for PTL and LBW and that periodontal disease is a sufficient infectious challenge to cause PTL and LBW. It was recommended that

large prospective studies be conducted to confirm the association between PTL and LBW and periodontal disease. Prospective studies were also suggested to determine if periodontal therapy can reduce the risk of PTL and LBW. ⁽²⁸⁾

The OCAP (Oral Conditions and Pregnancy) study was conducted over a 5 year period to determine if maternal periodontal disease contributes to the risk for prematurity and growth restrictions in the presence of traditional obstetric risk factors. ⁽³³⁾ To determine the risks, full mouth periodontal examinations were conducted at enrollment which was before 26 weeks gestational age and again 48 hours after delivery. The data suggested that periodontal disease at antepartum is significantly associated with higher prevalence of PTB. For periodontally healthy mothers the prevalence of births <28 weeks was 1.1%; mothers with mild periodontal disease was 3.5%; and, 11.1% among mothers with moderate-severe periodontal disease. In addition, similar patterns were noted among mothers with LBW infants. No babies were born with a birth weight of <1000g among periodontally healthy mothers, compared to 6.1% with mild periodontal disease and 11.4% with moderate periodontal disease. The data demonstrates a “dose-response” relationship between increasing periodontal severity and increasing prematurity as well as LBW. The investigators suggested that periodontal disease is a risk factor for adverse pregnancy outcomes and is as important as other known risk factors such as smoking, alcohol and genitourinary tract infections. ⁽³³⁾

To study the relationship between fetal inflammatory and immune responses to oral pathogens and risk for PTB a prospective observational study was conducted by Boggess et al. ⁽³⁴⁾ Enzyme-linked immunosorbent was used to determine C-reactive protein, interleukin (IL)-1 β , IL-6, tumor necrosis factor (TNF)- α , Prostaglandin E2, and 8-isoprostane in the

serum level of 640 umbilical cord blood specimens. The presence of fetal immunoglobulin M (IGM) antibody against oral pathogens was determined and the detection of >1 oral pathogen specific antibody was categorized positive. The results indicated that out of 640 births, forty eight (7.5%) delivered preterm. PTB were higher if categorized as high versus low 9-isoprostane or TNF- α (23 vs 5%) and (10 vs 4%). The rate of PTB was also higher if categorized as IgM positive versus negative (10.6% vs 5.8%). According to this study the joint effects of fetal IgM seropositively, detectable C-reactive protein, or high 8-isoprostane, PGE₂ or TNF- α resulted in a significantly increased risk for PTB. Fetal exposure to oral pathogens evidenced by IgM response is associated with PTB, in addition, the risk for PTB is greatest among fetuses that also demonstrate an inflammatory response.⁽³⁴⁾

Another prospective study was conducted by Boggess et al to determine if periodontal disease is associated with the delivery of a small –for- gestational -age infant.⁽³⁵⁾ Periodontal disease was categorized in this study as healthy, mild, moderate or severe and small for gestational age was defined as less than the 10th percentile for gestational age. The results indicated that out of 1017 woman, sixty seven 6.6% delivered a small for gestational age infant and one hundred forty three 14.3% of the woman had moderate or severe periodontal disease. The small for gestational age infant rate was higher among women with moderate to severe periodontal disease, compared to those with healthy or mild periodontal disease. The authors concluded that women who are pregnant and have severe or mild periodontal disease early in pregnancy are at greatest risk to deliver a small for gestational age infant.⁽³⁵⁾

The OCAP (Oral Conditions and Pregnancy) prospective study by Offenbacher was conducted to estimate if periodontal disease was predictive of preterm birth which is less than 37 weeks or very preterm birth less than 32 weeks. The OCAP study was conducted on 1,020

pregnant women whom received examinations both before and after delivery. To estimate whether maternal exposure to either periodontal disease at enrollment (less than 26 weeks) or periodontal disease progression during pregnancy, periodontal status before and after delivery was compared and was predictive of PTB and very low PTB. Risk factors that were adjusted for were previous PTB, race, smoking, social domain variables, and other infections. The results showed that preterm delivery was present among 11.2% periodontal healthy women and 28.6% women with moderate-severe periodontitis. Periodontal status before delivery was associated with an increased incidence of spontaneous PTB 15.2% versus 24.9%. PTB was 6.4% among women with periodontal disease progression compared to 1.8% of woman with out disease progression. As demonstrated in the OCAP study, maternal periodontal disease increases relative risk for preterm or spontaneous PTB. With this, independently of traditional risk factors, periodontal disease progression during pregnancy was a predictor of the more severe adverse pregnancy outcomes of PTB. ⁽³⁶⁾

As a secondary analysis of data that had been collected on the previous OCAP study, maternal factors that potentially were associated with fetal exposure to oral pathogens were examined along with the role of vaginal bleeding and fetal exposure to oral pathogens in preterm birth. The data were complete for 661 women, two hundred and thirty 34.8% with fetal exposure to oral pathogens and four hundred thirty one 65.2% without fetal exposure to oral pathogens. The results indicated that after the adjusted ratio for women with PTB and first or second-trimester bleeding along with fetal exposure to oral pathogens was 95%. Increasing the risk for PTB, vaginal bleeding is associated with fetal exposure to oral pathogens. The investigators concluded that further research needs to be conducted in whether vaginal bleeding is the cause of or a result of fetal exposure to oral pathogens. ⁽³⁷⁾

A pilot intervention study was conducted to determine if the treatment of periodontitis reduces the risk of PTB.⁽³⁸⁾ Three hundred sixty-six pregnant women between 21 and 25 weeks of gestation were randomized to one of three treatment groups with stratification on the following two factors: 1) previous spontaneous preterm delivery (SPTB) at ≤ 35 weeks and 2) body mass index < 19.8 of bacterial vaginosis. The treatment group consisted of patients receiving a dental prophylaxis plus placebo capsule, scaling and root planing (SRP) plus placebo capsule; and SRP plus metronidazole capsule (250mg t.i.d) for one week. In addition 723 pregnant women whom met the same criteria for periodontitis, enrolled in a prospective study and served as an untreated reference group. The results indicate that the rate of preterm delivery at < 35 weeks was 4.9% in the prophylaxis group, compared to 3.3% in the SRP plus metronidazole group and 0.8% in the SRP plus placebo group ($p=0.75$ and 0.12 respectively). When compared to the reference group the rate of preterm delivery < 35 weeks was 6.3%. In this particular population, performing SRP in pregnant women may reduce preterm delivery. However, metronidazole therapy did not improve pregnancy outcomes. The authors indicate that larger trials will be needed to achieve statistical significance.⁽³⁸⁾

To evaluate the effects of second-trimester SRP and the use of a sonic toothbrush on the rate of PTB < 37 weeks of gestation, Offenbacher et al conducted a randomized, delayed treatment, controlled pilot trial. Secondary outcome measures that were included were periodontal status, effects of therapy on the levels of oral inflammatory mediators, the levels of bacterial pathogens within the plaque, and the serum inflammatory response. The results indicate that treatment improved periodontal health, was safe and prevented periodontal disease progression. Preliminary data show a 3.8-fold reduction in the rate of PTB, a

decrease in periodontal pathogen load, and a decrease in both GCF IL-1 β and serum markers of IL-6. Further studies are needed to substantiate early findings. ⁽³⁹⁾

Gazolla et al conducted a randomized clinical trial to determine if periodontal treatment on pregnant women with periodontal disease affected the weight or delivery of the newborn. ⁽⁴⁰⁾ Four hundred and fifty pregnant women were selected for this study who were under prenatal care in Tres Coracoes, Brazil. One hundred twenty-two pregnant women were labeled as healthy and without periodontal disease. Three hundred twenty eight were labeled as “sick” and having periodontal disease. After 62 “sick” patients dropped out of the study, the “sick” group was divided into two groups, the “treated sick” which had 266 pregnant women with periodontal disease and the, “non-treated sick” with 62 pregnant women with periodontal disease that dropped out of the study. During the first trimester of pregnancy, all participants were give oral hygiene instructions, a toothbrush, toothpaste and dental floss at each visit. Periodontal treatment was performed during the second trimester of pregnancy. Periodontal treatment involved dental prophylaxis, supragingival and subgingival SRP. After periodontal treatment was conducted, patients were instructed to use 0.12% Chlorhexidine mouth rinse twice daily with their regular oral hygiene regimen. During the third trimester an evaluation was conducted. Success was measured by probing depth decrease and no bleeding. All 388 subjects were visited at their homes after giving birth to record the duration of pregnancy and the weight of the newborn infant. The “non-treated sick” groups weight and duration of pregnancy was retrieved from the Public Health Office in Tres Coracoes. The results indicate that there was no statistical difference between the healthy subjects and the subjects that were treated for periodontal disease. However, the results show that the prevalence of preterm LBW for the “non-treated sick” group was (79%) higher when

compared to the other groups. Along with this, education level, previous PTB and periodontal disease were significantly related to PTB ($P>0.001$). It is concluded that periodontal disease is significantly related to preterm LBW and that periodontal treatment during pregnancy should be included in prenatal care programs. ⁽⁴⁰⁾

Studies That Found No Relationship Between Periodontal Disease and Preterm Birth

Michalowicz et al conducted a large investigation to determine if nonsurgical periodontal treatment in pregnant women reduced the risk of delivery before 37 weeks and resulted in a greater birth weight and a reduced proportion of infants who were small for gestational age. Women were assigned randomly to undergo SRP before 21 weeks gestation or after delivery. The patients in the treatment group received SRP and also underwent monthly tooth polishing and oral hygiene instructions. Control patients received only a brief oral examination at monthly follow ups. After delivery the control group was offered the same periodontal therapy. Patients were monitored for oral adverse events such as the progression of periodontitis. Treatment for patients with progressing periodontal disease was not delayed in the control or treatment group unless treatment was contraindicated. PTB occurred in 49 of 407 women in the treatment group and in 52 of the women in the control group. Although periodontal treatment improved periodontitis measures, it did not significantly alter the risk of PTB. It was concluded that although the treatment of periodontal disease in pregnant women is safe and improves periodontal disease, it does not alter the rates of PTB, LBW or fetal growth restriction. One reason for such results may be due to the fact that treatment was rendered too late into the pregnancy. Additional studies are recommended to determine if periodontal treatment provided earlier in pregnancy or before conception will improve adverse pregnancy outcomes. ⁽⁴¹⁾

To test the relationship between periodontal disease in women and PTB and LBW, a population based, cross-sectional study was conducted in Brazil. ⁽⁴²⁾ Three specific outcomes were examined: LBW, prematurity, and prematurity and/or LBW. Four hundred forty nine pregnant women were interviewed and examined up to 48 hours post-partum. Periodontal examinations were conducted on all teeth using calibrated periodontal probes. Maternal health and habits were measured in a questionnaire after the periodontal examination. The depths of gingival sulci were measured and bleeding on probing was observed. The results reported that periodontal pockets were not associated with LBW and or PTB. An association was found between prematurity and periodontal pockets, but it was confounded by maternal health variables. ⁽⁴²⁾

A population-based, case control study was conducted to establish whether patterns of periodontal care especially cessation of periodontal care during pregnancy was associated with an increased risk of LBW babies. ⁽⁴³⁾ Seven hundred ninety three cases were defined with infants weighing <2,500g and a random sample of 3,172 controls with infants >2,500. The case control population base was selected consisting of all women who had known eligibility for dental insurance both prior to and during pregnancy between 1993 and 2000. The case group consisted of all pregnancies between 1993 and 2000 resulting in LBW infants. The patterns of periodontal care were established based on the presence or absence of SRP or periodontal maintenance prior to and during pregnancy. Four patterns of periodontal care were defined: No periodontal care: cessation of periodontal care during pregnancy: periodontal care prior to and during pregnancy: and, periodontal care during pregnancy only. The results found that periodontal care utilization was associated with at 2.35-fold increased odds of self-reported smoking during pregnancy, a 2.19-fold increased odds for diabetes, and

a 3.90-fold increased odds for black race and higher maternal age. After these factors were adjusted the interruption of periodontal care during pregnancy did not lead to an increased risk for LBW infant when compared to women with no history of periodontal care. Women who received periodontal care had genetic and environmental characteristics, such as smoking, diabetes, and race that were associated with an increased risk for LBW infants. In this study periodontal care patterns alone were unrelated to LBW infants.⁽⁴³⁾

To measure the association of maternal periodontitis with LBW, PTB, and intra-uterine growth restriction, Bassani et al conducted a case-control study.⁽⁴⁴⁾ Subjects were examined for periodontitis through attachment loss, information on perinatal outcomes and general health. Three hundred and four cases along with 611 controls had similar prevalence and severity of periodontitis. This was defined as at least 3 sites in different teeth, with loss of >3mm of clinical attachment. Several factors were associated with the outcome, but the crude odds ratio for periodontitis was not significant. Odds ratio was 0.93 for LBW and 0.92 for PTB in the presence of periodontitis, after adjusting for maternal age, previous pregnancies, pre-natal care, smoking, previous LBW or premature birth and other medical conditions. The results indicate that adverse pregnancy outcomes are better explained by determinates other than periodontal health. The association of periodontitis and PTB and LBW infants should be further studied especially in instances of severe periodontitis.⁽⁴⁴⁾

Insurance Companies and the Oral-Systemic Link

As studies emerge insurance companies are becoming more aware of the strong relationship between poor oral health and certain systemic conditions. Preventative treatment in the dental office could prevent a systemic condition which in turn allows patients and insurance companies to save on medical expenses. Some insurance companies are adding

enhanced benefits to insurance plans that target at high-risk populations. For example Aetna inc. is adding free additional scaling and periodontal maintenance for pregnant women, heart disease and patients with diabetes. ⁽⁴⁵⁾ Cigna Corp. is including full coverage for SRP and periodontal maintenance for pregnant women, patients with diabetes and heart disease. ⁽⁴⁵⁾ In addition to this Cigna is also offering an extra regular prophylaxis to pregnant patients. The enhanced benefits are being favored by big companies who have to cut medical costs. According to the *Colgate Oral Care Report*, when insurance nurses were allowed to call employees with conditions such as diabetes, heart disease or pregnant women and invite them to see a dentist, 36% of 2,200 accepted the invitation. Not only are insurance companies offering preventative benefits, some insurance companies are now covering advanced treatment for missing or damaged teeth, such as implants, bridges, and composite fillings. ⁽⁴⁵⁾ Having the insurance's buy in along with the medical community is one of the first steps to improving oral health and educating patients on the oral systemic link.

The type of dental insurance that a patient is covered by regardless if it is private or government funded it is a central predictor of dental care utilization. In today's society individuals insured by the government are faced with higher incidences of oral diseases and less access to care. In the United States on average one third of all births are covered by Medicaid. ⁽⁴⁶⁾ The eligibility of dental care in adults can vary widely from partial dental coverage to no dental coverage at all in certain states. Today there are 7 jurisdictions providing comprehensive care to eligible adults. However, in 8 states in the U.S, women who are pregnant and covered by Medicaid have no dental benefits. ⁽⁴⁶⁾ The relief of pain or dental infection is covered in 18 states along with the eligibility for a limited range of services in 18 states. However, with the central goal in mind to reduce

adverse pregnancy outcomes in women, Utah, California and Louisiana have expanded benefits specifically for expectant women. ⁽⁴⁶⁾ Boggess et al suggested that the 9 months of gestation may be the only time that low income pregnant women can obtain dental coverage due to the fact that many states only provide adult dental coverage or enhanced benefits to women during pregnancy. ⁽⁴⁶⁾

Pregnant Women's Knowledge and Behaviors Regarding Oral Health

Oral health during pregnancy plays an important role in the health of infants. Studies suggest that adverse pregnancy outcomes are linked to the mother's oral health status. ⁽²⁾⁽¹¹⁾⁽¹³⁾ To increase awareness regarding the oral-systemic link, health care providers must collaborate to educate pregnant patients before and during pregnancy. The Center for Disease Control and Prevention (CDC), Division of Oral Health attempted to look at women's knowledge and attitudes regarding oral health and dental visits during pregnancy. Data was used from the CDC Pregnancy Risk Assessment Monitoring System (PRAMS) which surveys women's attitudes, experiences, and behaviors before, during and after pregnancy. The findings indicate that most women do not visit the dentist during pregnancy, and of those who reported having oral problems, one-half did not seek care. The qualitative results show that many pregnant women believe that poor oral health is normal during pregnancy and that some dental procedures could harm the unborn child. In conclusion, oral health needs and behaviors of pregnant women need more attention from researchers and health program planners to educate women about the importance of oral health during pregnancy. ⁽⁴⁷⁾

Habashneh et al conducted a study to investigate factors related to the utilization of dental care rendered during pregnancy along with assessing mothers' knowledge regarding oral health during pregnancy and its affect on the pregnancy outcomes. Six hundred twenty

five mothers who gave birth from August 2001 to March 2002 in Johnson County, Iowa were mailed a survey. The mailed survey assessed knowledge, behaviors, and attitudes toward dental care during pregnancy along with personal, demographic and pregnancy-related factors. The results reported that out of a response rate of 69%, only 49% reported visiting the dentist while pregnant. Being aware of the connection between oral health and adverse pregnancy outcomes was reported by 43%. Factors that were associated with reporting dental visits during gestation were personal factors such as marriage status, greater frequency of dental visits when not pregnant and the use of inter-proximal aids. Also financial factors such as dental insurance and knowing the possible connection between oral health and adverse pregnancy outcomes were also associated with dental visits during pregnancy. It is concluded that out of a high socioeconomic status standing group of women, the knowledge of the relationship between oral health and adverse pregnancy outcomes was limited. It is suggested that oral health education is vital to women before and during pregnancy to bring greater attention to the importance of oral health and adverse pregnancy outcomes. ⁽⁴⁸⁾

In order to promote oral health in patients during gestation all health care professionals that are involved in the care of the patient must be involved. Dentists, dental hygienists, physicians, and nurses must join forces to provide oral health exams, refer patients as needed and educate about the oral-systemic link and its possible relationship to adverse pregnancy outcomes. ⁽²⁾⁽¹¹⁾⁽¹³⁾

Physicians' Knowledge and Behaviors Regarding Oral Health

Physicians are in the position to prevent oral disease but they may lack the knowledge and skill to do so. Lewis et al conducted a national survey of 1,600 pediatricians and found that ninety percent felt that they had an important role in identifying dental problems and

teaching prevention to families. However, only half of the physicians reported that they had training in medical school or residency regarding dental issues. In addition only 9% answered correctly in the knowledge section of the survey on oral health questions. ⁽⁴⁹⁾ McCundiff et al showed that only 7% of primary care physicians performed an oropharyngeal cancer examination on patients and that their knowledge level needed to be more current. ⁽⁵⁰⁾

Wilder et al conducted a study with one hundred ninety four practicing obstetricians in a five county area in central North Carolina. ⁽⁵¹⁾ Of the 138 eligible physicians, 55 responded yielding a 40% response rate. Most answered correctly when asked about the description of gingivitis 95%. A lower number of respondents were correct when asked about the description of periodontitis 67%. When asked about what causes periodontal disease or what is associated with periodontal disease, most answered correctly with bacteria 94%, although many answered tooth decay 73%, aging 69% and excess dietary sugar 51%. Most were correct in responding that periodontitis was more serious than gingivitis 80%. Twenty two percent looked into patients' mouths at initial prenatal examination, 9% periodically, and 48% only when a problem was mentioned by the patient. Forty nine percent rarely or never recommended a dental examination. Most 84% considered periodontal disease to be as important a risk factor to adverse pregnancy events as those currently known in obstetrics practice. This study suggests that there may be limited incorporation of dental care in medical settings. ⁽⁵¹⁾

At the University of Washington (UW) the medical school has conducted extensive research on the knowledge level of medical students regarding oral health and its relationship to overall health. ^(52, 53) Investigators at UW estimated that medical students received about two hours of lecture on oral health during their four years of medical school. In 2005, a new

oral health elective was created at the UW Medical School to provide students the opportunity to learn more about oral health. The goal of the curriculum was to provide medical students with knowledge, attitude and skills to graduate and provide preventative care. Knowledge objectives incorporated into the curriculum included public health, pathogenesis of the most common oral diseases, caries, periodontal disease and oral cancer, and the behavioral aspects of oral health such as oral cancer risk, diet and prevalence of caries, oral hygiene and periodontal disease, and periodontal disease and systemic health. Attitudinal objectives included the awareness that oral health is important to overall health; physicians have a role in preventing oral disease and identifying it early; and, the importance of collaboration between dentists and physicians. The lectures were taught by nine pairs of medical and dental faculty. After each lecture there was a clinical laboratory or an interview with a patient to enable the medical students to get practical experience. Dental students served as volunteers during the laboratory exercises, and they assisted the medical students during the performance of oral exams and the application of fluoride varnish. Thirty medical students were enrolled in the elective. The results of the pre and posttest of oral health attitudes, confidence and knowledge were that the students' attitudes toward oral health were more positive at the completion of the course, and their confidence in identifying oral disease was higher ($p < .001$). The greatest attitudinal shift was observed on several items of the pre-survey and post-survey including the importance of discussing the patient's oral health issues with their dentist, and the importance of educating patients about tooth brushing and flossing. Medical student's confidence levels increased most in their ability to recognize dental decay in a patient. Students' overall knowledge score improved ($p < .001$), with increases in their scores on items assessing caries ($p < .001$) as well as oral-systemic issues ($p < .001$). There was

no change in knowledge level in public health issues and some misconceptions still existed on several basic facts such as numbers of primary teeth in children. This course has now become a permanent elective for medical students after a great deal of positive feedback. ^(52, 53)

Nurses' Knowledge and Behaviors Regarding Oral Health

Nurses are extremely important to the care of patients in all aspects of their health. They are in an ideal position to be a health care provider to screen, refer and promote periodontal health. Many times barriers such as inadequate knowledge and skills towards oral health prevent oral health promotion. One hundred fifty eight primary care nursing centers were surveyed in the United States to determine to what extent they provide oral health screening, education, and referral services for clients. Participants were also surveyed regarding identifying factors that discourage and encourage these services. ⁽⁵⁴⁾The investigators reported that nearly half of the responding nurses at primary care nursing centers “almost always” screen patients for gum infections 49%, and oral lesions 48%. Fewer nurses teach their patients how to perform oral cancer self-examinations 20%; the effects of xerostomia 19% and the benefits of fluoride 38%. However, the majority reported not always referring patients for dental decay 55%, gum infections 61%, missing teeth 80%, oral lesions 67%, oral pain (%), or oral trauma 65%. Factors that discouraged referrals were lack of referral sources 64% and unavailability of health care professionals to provide on site basic oral health services in the centers 63%. Factors that encouraged the integration of oral health services into primary care nursing centers were an appreciation for the benefits of oral health 73%, and a knowledgeable clinician to perform oral health services 68%. This data provides

support for the collaboration of the oral healthcare professional and nurses to expand oral health services. ⁽⁵⁴⁾

A study was conducted to assess nurses' knowledge and education in relation to oral care and oral health assessment for patients undergoing cancer treatment. A non-random sample of one hundred nurses was surveyed. The participants were general nurses or oncology nurses. Forty six percent had received both theoretical and clinical education in oral care during their general nurse education. However, only 10% reported having a lot of education in oral care, while 43.1% had received no education in oral care on cytotoxic drugs or radiation treatment during general nurse education. Theoretical and clinical education in oral care during oncology nurse education was reported by 63%. Only 7.1% of cancer nurses reported receiving a lot of education in oral care during oncology nurse education. In the past year only 11% of general nurses and 19.4% of cancer nurses reported attending continuing education in oral care. However, 94.5% of oncology nurses indicated the need for continuing education on oral health. These findings suggest that substantial oral health education is lacking in nursing schools. ⁽⁵⁵⁾

Primary care providers such as family physicians, pediatricians, registered nurses, physician assistants, and nurse practitioners could play an important role in preventative services. These services include very young children and those individuals with limited access to dental care.

In January, 2008, the Journal of Maternal Child Nursing (MCN) published an issue devoted entirely to oral health. In the issue was a paper by Clemmens and Kerr introducing a Nurses' Plan of Action to respond to "largely preventable diseases"—namely oral health problems. ⁽⁶⁰⁾The authors stressed the need for nurses to understand the range of oral health

problems associated with systemic and chronic health conditions. However, with little integration of oral health topics in nursing curricula, it is unlikely that this will be accomplished quickly. ⁽⁶¹⁾

The purpose of this study was to find out if there is relationship between Nurse Practitioners (NP), Physician Assistants (PA) and Nurse Midwives' (CNM) knowledge and practice behaviors regarding periodontal disease and adverse pregnancy outcomes

MATERIALS AND METHODS

In September 2007, all NPs, PAs and CNMs who provide prenatal care in North Carolina were surveyed via a mailed questionnaire. Prior to the mailing a sample of six prenatal care providers including three NPs, two PAs and one CNM pilot tested the survey instrument. The recommendations from the pilot test were reviewed and a final draft of the survey instrument was completed with necessary revisions.

The stamped, pre-addressed survey packets were mailed to study participants. Included was a cover letter explaining the purpose of the research study and the importance of their participation. An IRB explanation letter was included explaining the study along with an information request form that was used in an incentive drawing for five, one hundred dollar gift cards from American Express. A blank envelope was included in the survey packet for the participants to place the information request form. The blank envelopes with the information request form were stored in a locked file cabinet and opened when the survey was completed. Identification numbers were placed on the individual surveys to ensure subject confidentiality while permitting a second mailing of non-respondents to the first mailing. Subjects were asked to return the completed surveys along with the information request form sealed in the blank envelope three weeks after the survey was mailed.

The survey contained closed and open-ended questions addressing four principal areas; (1) knowledge about periodontal disease and adverse pregnancy outcomes; (2) practice behaviors as they relate to periodontal disease and adverse pregnancy outcomes; (3) opinions/perceptions of the NPs, PAs and CNMs regarding oral health; and, (4) demographics. The data from the completed questionnaires were entered into an excel database. The data was transferred to SPSS for windows for complete analysis.

RESULTS

Demographics

A total of 240 NPs, PAs and CNMs responded to the mailed survey, achieving a response rate of 48%. Thirty surveys were returned due to insufficient address.

Eighty six percent of participants reported providing prenatal care in North Carolina to an average of 45 patients per week (range 1-350). Almost half reported working of which 41% were employed in a public health facility or government funded facility. The majority of providers had provided prenatal care for more than 6 years (Table 1).

Oral Periodontal Examinations

Almost two-thirds (63%) of providers reported looking in a patients' mouth (oral health examination) as part of routine care at the initial visit. Six percent reported never looking in the patient's mouth, and 43% looked only if the patient identified a problem. For those who did not perform an oral health exam, 20% indicated that they felt it was the responsibility of dental professionals.

Practice Behaviors

Participants were asked what prenatal care services are provided at their work setting. Ninety eight percent reported providing low risk care to patients, while 84% reported providing Non Stress Test (NST). Ultrasound examinations were provided in 81% of prenatal care services. Nutrition consultation is provided by 78% of participants and high risk care in 75% of work settings. Forty four percent reported providing genetic consultation while only

33% reported providing dental screening and 22% reported providing dental care as prenatal services. (Table 2)

When asked in the last 12 months what referrals were made for their prenatal patients, 97% reported referring for genetic screening and 96% indicated they referred for nutrition. Ninety four percent referred for childbirth preparation and 93% referred for WIC (Women Infant Children). Eighty eight percent of patients were referred for social work while 87% reported referring for dental health. Eighty four percent prenatal patients were referred for baby love in the last 12 months.

Health care providers reported that 1-90% with a mean of 26% of their patients experience problems with their gums. When asked what trimester is recommended to patients for dental treatment most 55% reported the first trimester. Forty percent of participants recommend patients for dental treatment in the second trimester while 1% recommend dental treatment in the third trimester.

When assessing knowledge known about risk factors for adverse pregnancy outcomes, 96% maternal smoking, 82% multiple gestation, 68% reported exposure to second hand smoke and 63% reported periodontal disease. Other known risk factors reported included a previous preterm delivery (57%), caring for a cat (39%) and advanced maternal age (women 35 and older) (33%). (Table 3)

Knowledge

Participants were asked what they believe to be associated with gum disease. Eighty four percent reported bacteria being associated with gum disease, 78% reported smoking, and 76% believed that tooth decay to be associated with gum disease. However, 61% indicated that excess sugar consumption is associated with gum disease. (Table 4)

Participants were asked what describes gingivitis. Seventy percent answered a reversible redness and or swelling of the gums while 50% said a potentially reversible infection of the gums. Participants were also asked what describes periodontitis. Sixty six percent said a potentially reversible infection of the gums while 27% indicated tooth decay. Ninety four percent stated that periodontitis was worse than gingivitis.

Opinions

When asked if the health care professional was personally trained to provide an oral exam, only 43% reported being trained to provide an oral exam. Fifty three percent agreed that they should be taught how to perform a cursory examination to determine health or disease. Fifty two percent said they need to collaborate with dental professionals to reduce a patient's risk of having an adverse pregnancy outcome. Forty nine percent agreed that in recent years an association has been made between periodontal disease and adverse pregnancy outcomes and 55% agreed that if a patient has periodontal disease she is more likely to have adverse pregnancy outcomes than a patient with healthy gums. (Table 5)

When asked what is the single most important reason for not providing an oral health exam on patients 20% indicated that it was the responsibility of dental professions. Seventeen percent stated that they were not sure what to do while 9% said that it takes to much time.

DISCUSSION

The survey was designed in an attempt to find out if there is relationship between NPs, PAs and CNMs knowledge and practice behaviors regarding periodontal disease and adverse pregnancy outcomes. While a larger response rate was anticipated, the response rate of 48% is enough to assess the knowledge and practice behaviors of health care professionals regarding periodontal disease and adverse pregnancy outcomes. The response rate may have been lower due to individuals moving and not updating their addresses with the North Carolina Medical Board and the North Carolina Nursing Board where names and addresses were accessed for this study.

Non response bias was examined with the information that was provided from the mailing list. There was no apparent response bias, but it should be recognized that some response bias could be present. However, non response bias can not be fully assessed with the information given from the medical board.

The results might not have external validity and may not be generalized to other locations. Results are based on a sample of NPs, PAs and CNMs working in North Carolina; they might not be representative of nurse practitioners in other states.

With the possible links that have been established between periodontal disease and certain systemic conditions, it is imperative that all healthcare practitioners be aware of a patient's oral health condition. ⁽⁶²⁾ Oral health during pregnancy plays an important role in the health of infants. Studies suggest that adverse pregnancy outcomes are linked to the mother's oral health status. ⁽²⁾⁽¹¹⁾⁽¹³⁾ To increase awareness regarding the oral-systemic link,

health care providers must collaborate to educate pregnant patients before and during pregnancy. In this study 52% of NPs, PAs and CNMs agreed that they need to collaborate with dental professionals to reduce patient's risk of having an adverse pregnancy outcome. Eighty six of the respondents reported providing prenatal care in N.C. Improvements can be made by educating nurses in oral health and adverse pregnancy outcomes. Several ways to educate nurses is for them to attend continuing education courses on periodontal disease and systemic conditions, having a dental hygienist explain and demonstrate an oral health exam, having referral sources available for practitioner so they can easily refer pregnant women for oral health care needs and having oral health content added to the curriculum for nurses, physician assistants, nurse practitioners, and certified nurse midwives' who provide prenatal care.

With the proper education and training, it is recommended that NPs, PAs and CNMs should start providing oral exams to all pregnant mothers who are not receiving routine dental exams. Pregnant women who have bleeding gums, loose teeth, bad breath or inflammation should be referred to a dentist, dental hygienist or dental clinic. Nurses should proactively identify dental clinics that will accept expectant mothers with out insurance or financial barriers. In the current study, 49% NPs, PAs and CNMs agreed that they knew dentists who they can refer patients to if needed. The number of potential referral sources could be increased through a collaborative effort between oral health care providers and NPs, PAs and CNMs.

According to the NY State Practice Guidelines, pregnancy by itself is no reason to defer routine dental care and necessary treatment. In the first trimester, diagnosis and treatment can be implemented along with radiographs if needed to diagnose an immediate

treatment need. While treatment can occur anytime during pregnancy the ideal time is between the 14th and 20th week of gestation. ⁽⁶³⁾ Offenbacher et al reported that the risk of very PTB is potentially caused by the systemic increase in inflammatory chemicals released by the body in response to periodontal disease. Thus a patient with periodontal disease needs appropriate treatment regardless if she is pregnant or not. ⁽³⁶⁾ Not only would necessary dental care possibly decrease adverse pregnancy outcomes in infants but it could also benefit individual families and infants and improve the economic benefits through lower health care cost. ⁽⁶⁴⁾

Nurses, NPs, PAs and CNMs are in an ideal situation to identify and refer pregnant women that need dental care. Prevention through education is also necessary for prenatal care providers to teach mothers the importance of a healthy smile and a healthy baby. ⁽⁶⁵⁾ Several steps can be taken to integrate nursing and oral health. The best place to start is in the curriculum of nursing programs. Curriculum changes must take place to integrate more content curricula about oral health and evidenced based content regarding oral systemic disease. Another avenue to increase knowledge about oral health is through continuing education of nursing professionals Topics could include the basics of an oral assessment, periodontal disease risk factors and overall risk assessment. Another step that should be taken is for nurses along with oral health providers, to understand the barriers to obtaining oral healthcare and work to removing such barriers. Nurses could also educate women about the effects of tobacco and alcohol on oral health. These are initial steps that can be taken to help nurses play a vital role in improving oral health in pregnant women ⁽⁶⁰⁾

While the University of Washington has added a new oral health elective for the medical school, other institutions are also taking the initiative to integrate oral health into

their curricula .New York University's Dental School and Nursing School have combined their curriculum in order to provide comprehensive care to all patients. NP's are providing continuous primary care, immunizations, cholesterol screening, and many other health promotion/disease prevention activities to dental patients and referring them as needed. NYU nursing students understand the relationship between oral health and systemic health and are collaborating with dentists to improve the oral health of patients who come through their clinics. ⁽⁶⁶⁾ ⁽⁶⁷⁾

Further research is needed to identify barriers in nursing curriculum that exclude the incorporation of oral health content as it relates to oral and overall health. Another study that could be conducted is assessing, nursing school educators' attitudes, knowledge and beliefs regarding periodontal disease and adverse pregnancy outcomes.

CONCLUSION

NPs, PAs and CNMs providers did not have adequate oral health education in their curriculums. Few prenatal care providers feel that they are adequately trained to provide an oral health examination. The current research indicates that increased oral health education in NPs, PAs and CNMs academic programs could increase the knowledge level regarding periodontal disease and adverse pregnancy outcomes. In addition this study found that NPs, PAs and CNMs collaborating with dental professionals to provide better care for pregnant patients. There are many opportunities in various work settings for nurses to educate, promote oral health and provide risk assessment to women

Table: 1 Respondents Personal Experience

Prenatal Care Providers (n=239)

Yes 86 % (207)

No 13 % (32)

Patients Seen Each Week (n=202)

Per week 1-350 (202)

Mean 45

SD 43

Practice Setting

General Practice 10 % (19)

Solo .4 % (1)

Group 12 % (29)

Specialty Practice 35 % (69)

Public Health/Government 41 % (79)

Hospital Practice 12 % (23)

Other 2 % (4)

Number of Years in Practice (n=208)

Less than 1 year	1% (1)
1-2 Years	11% (23)
3-5 Years	14% (30)
6-10 Years	25% (51)
11-20 Years	33% (69)
More than 20 years	16% (34)

The Last Time You received Dental Care (n=201)

Within the last six months	79% (159)
6 months-1 year ago	13% (27)
1-2 Years ago	6% (12)
2 or more years ago	2% (3)
Never	0% (0)

Last Examination to Assess the Health of Your Gums (n=202)

Within the last six months	78% (158)
6 months-1 year ago	14% (29)
1-2 Years ago	6% (12)
2 or more years ago	2% (3)
Never	0% (0)

Have You Ever Been Told You Have Periodontal Disease (n=202)

Yes	13% (26)
No	85%
Maybe	2% (4)

Rating of Oral Health (n=203)

Excellent	42% (86)
Good	54% (109)
Fair	4% (8)
Poor	0% (0)
Very Poor	0% (0)

Table 2: Prenatal care services provided by NP, PA and CNM

	Yes ▼	No ▼
Childbirth Classes (n=175)	55% (96)	45% (79)
Nutrition Consultation (n=191)	78% (148)	23% (43)
Dental Screening (n= 159)	33% (53)	67% (106)
Dental Care (n=157)	22% (34)	78% (123)
Genetic Consultation (n= 169)	44% (74)	56% (95)
Low Risk Care (n= 197)	98% (192)	39% (5)
High Risk Care (n= 185)	75% (139)	25% (46)
Ultrasound Examinations (n=187)	8% (151)	19% (36)
Biophysical Profile (BPP) (n=178)	65% (116)	35% (62)
Non Stress Test (NST) (n=195)	84% (163)	16% (32)

Table 3:

Practitioners' estimation of level of risk for adverse pregnancy outcomes associated with conditions and behaviors of mother

	Definite Risk ▼	Possible Risk ▼	Uncertain ▼	Probably No Risk ▼	Definitely No Risk ▼
Maternal Smoking (n=207)	96 % (198)	4 % (9)	0 %	0 %	0 %
Second Hand Smoke (n=207)	68 % (140)	28 % (58)	4 % (8)	1 % (1)	0 %
Periodontal Disease (n=208)	63 % (130)	30 % (62)	7 % (15)	0 %	0 %
Taking care of a cat (n=208)	39 % (80)	55 % (114)	0 %	6 % (13)	1 % (1)
Bacterial Vaginosis (n=206)	35 % (71)	53 % (110)	5 % (11)	7 % (14)	0 %
Multiple Gestation (n=208)	82 % (171)	17 % (36)	1 % (1)	0 %	0 %
Family history of birth defect (n= 207)	29 % (60)	67 % (138)	3 % (7)	0 %	0 %
Strenuous Exercising (n=205)	8 % (17)	53 % (108)	16 % (33)	21 % (43)	2 % (4)
Work outside the home (n=207)	3 % (7)	20 % (41)	13 % (27)	51 % (105)	13 % (27)
Previous Preterm Delivery (n=208)	57 % (119)	41 % (86)	1 % (2)	1 % (1)	0 %
Maternal age of 35 (n=207)	33 % (68)	59 % (122)	1 % (3)	7 % (14)	0 %

Table 4: NP, PA, CNM beliefs associated with gum disease (n=240)

Excess Sugar Consumption	61% (147)
Bacteria	84% (202)
Tooth Decay	76% (182)
Aging	55% (132)
Genetics	53% (127)
Child Bearing	43% (102)
Smoking	78% (187)

Table 5: Opinions of NP, PA and CNM

	Strongly Agree ▼	Agree ▼	Disagree ▼	Strongly Disagree ▼	Don't Know ▼
I am trained to provide an oral exam. (n=203)	4% (9)	39% (79)	36% (72)	18% (36)	3% (7)
I am adequately trained to provide an oral health diagnosis to patients. (n=205)	2% (3)	19% (38)	50% (102)	27% (55)	3% (7)
I am comfortable looking in a patient's mouth and determining if they have gum disease. (n=205)	3% (6)	45% (92)	38% (78)	9% (18)	5% (11)
I do not have enough time with each patient to provide an oral health exam. (n=205)	10% (20)	31% (63)	45% (92)	11% (22)	4% (8)
My knowledge about periodontal disease is current. (n= 203)	32% (65)	49% (99)	10% (21)	6% (14)	2% (4)
Nurse practitioners, physician assistants and nurse midwives should be taught about periodontal health. (n= 204)	51% (104)	48% (98)	0%	0%	1% (2)
I know dentists who I can refer patients to if needed. (n= 205)	32% (65)	49% (99)	10% (21)	7% (14)	2% (4)
I am knowledgeable regarding the studies linking periodontal disease to adverse pregnancy outcomes. (n= 205)	9% (18)	52% (107)	26% (54)	8% (16)	5% (10)
I need additional information about periodontal disease and its impact on adverse pregnancy outcomes. (n=203)	31% (64)	61% (124)	6% (12)	2% (3)	1% (2)
Good periodontal health is vital to a normal delivery. (n= 203)	25% (50)	53% (108)	11% (23)	0%	11% (22)
My patients are knowledgeable about the importance of good oral health during their pregnancy. (n= 240)	3% (5)	19% (39)	47% (96)	25% (51)	6% (12)
My patients are willing to seek dental care. (n=200)	6% (15)	37% (89)	30% (73)	5% (4)	6% (15)
My patients practice good oral health care. (n=205)	1% (2)	31% (61)	50% (99)	13% (26)	6% (12)

If a patient brushes and flosses her teeth regularly she will reduce her chances of having periodontal disease. (n=204)	48% (99)	51% (104)	0%	1% (1)	1% (1)
Nurse practitioners, physician assistants and nurse midwives should be taught how to perform a cursory examination to determine health or disease. (n=205)	40% (82)	53% (109)	2% (5)	0%	4% (9)
Nurse practitioners, physician assistants and nurse midwives should perform periodontal examinations to determine if a patient needs to be referred to a dentist. (n= 205)	29% (59)	50% (102)	14% (28)	1% (2)	7% (14)
Nurse practitioners, physician assistants and nurse midwives are qualified to perform a periodontal examination to determine if a patient needs to be referred to a dentist. (n=204)	17% (34)	40% (82)	28% (56)	6% (13)	9% (19)
Nurse practitioners, physician assistants and nurse midwives need to collaborate with dental professionals to reduce a patient's risk of having an adverse pregnancy outcome. (n=204)	43% (87)	52% (106)	2% (3)	0%	4% (8)
I am comfortable referring patients with dental problems. (n= 205)	58% (119)	40% (81)	2% (4)	0%	1% (1)
Periodontal disease is a risk factor for adverse pregnancy outcomes. (n=205)	38% (78)	51% (105)	1% (2)	0%	10% (20)
In recent years, an association has been made between periodontal disease and adverse pregnancy outcomes. (n=205)	37% (75)	49% (107)	1% (1)	0%	14% (28)
If a patient has periodontal disease she is more likely to have adverse pregnancy outcomes than a patient with healthy gums. (n=205)	31% (64)	55% (113)	2% (3)	0%	12% (25)
The research is inconclusive regarding the relationship between periodontal disease and adverse pregnancy outcomes. pregnancy outcomes. (n=205)	4% (9)	12% (24)	51% (105)	12% (25)	21% (42)

Appendix

Survey of North Carolina Nurse Practitioners, Physician Assistants and Certified Nurse Midwives: Oral Health

Please read each question carefully and provide your most appropriate response.

Practice Setting

1. Do you provide prenatal care?

☐₁ Yes

☐₂ No

IF NO, STOP HERE. Thank you for your time!

2. Approximately how many prenatal patients do you see each week?

#

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of patients per week

3. Which of the following BEST describes the type of practice in which you work the greatest number of hours? (CHECK ONLY ONE)

☐₁ General Practice: (choose one)

☐ Solo Practice

☐ Group Practice

☐₂ Specialty practice (specify): _____

☐₃ Public health/government

☐₄ Hospital practice

☐₅ Other (specify) _____

4. How long have you been providing prenatal care?

☐₁ Less than 1 year

☐₂ 1-2 years

☐₃ 3-5 years

☐₄ 6-10 years

☐₅ 11-20 years

☐₆ More than 20 years

**5. What prenatal care services are provided at your work setting?
(CHECK ALL THAT APPLY)**

	Yes ▼	No ▼
Childbirth Classes	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Nutrition Consultation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Dental Screening	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Dental Care	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Genetic Consultation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Low Risk Care	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
High Risk Care	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Ultrasound Examinations	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Biophysical Profile (BPP)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Non Stress Test (NST)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂

Oral Periodontal Examinations

6. When do you look in a patients' mouth (oral health examination) for periodontal problems such as gum disease? (CHECK ALL THAT APPLY)

- ☐₁ Never
- ☐₂ At initial visit only
- ☐₃ At every visit
- ☐₄ Only when problem is mentioned by patient only

7. Estimate the percentage of prenatal patients that you provide an oral health examination for gum disease at their initial (first comprehensive prenatal examination). If you do not provide this type of examination check "0".

- ☐₁ 0
- ☐₂ 1-20%
- ☐₃ 21-40%
- ☐₃ 41-60%
- ☐₄ 61-80%
- ☐₅ 81-100%

8. Estimate the percentage of prenatal patients that you provide an oral health examination for gum disease at their Follow- up appointment. If you do not provide this type of examination check “0”.

- ☐₁ 0
- ☐₂ 1-20%
- ☐₃ 21-40%
- ☐₃ 41-60%
- ☐₄ 61-80%
- ☐₅ 81-100%

9.If you do not provide an oral health exam on your patients, what is the single most important reason for not doing so? (CHECK ALL THAT APPLY)

Not necessary/not needed	<input type="checkbox"/> ₁
Responsibility of dental professionals	<input type="checkbox"/> ₁
Unsubstantiated by research	<input type="checkbox"/> ₁
Takes too much time	<input type="checkbox"/> ₁
Not sure what to do	<input type="checkbox"/> ₁
Not cost-effective	<input type="checkbox"/> ₁
Patients unwilling to pay for the procedure	<input type="checkbox"/> ₁
Not reimbursed by 3 rd party payers	<input type="checkbox"/> ₁
Other-Please specify: _____	<input type="checkbox"/> ₁

10. Is there a dental clinic located in the practice setting that you work in?
(If YES go to #11, If NO skip to question #12)

- ☐₁ Yes
- ☐₂ No Skip to Question 12

11. Which statement below best describes when you refer patients to a dental clinic?

(CHECK ALL THAT APPLY)

- ☐ ₁ I refer anytime a patient expresses a concern about her mouth or gums
- ☐ ₂ I refer a patient if I see something that I think should be further examined
- ☐ ₃ I never refer a patient to the dental clinic
- ☐ ₄ I refer as part of the patient's health promotion and disease preventative care.

AFTER ANSWERING QUESTION 11, SKIP TO QUESTION 13

12. If you do not have a dental clinic in your practice setting, do you have a dental office or school to refer prenatal patients to?

- ☐ ₁ Yes
- ☐ ₂ No

13. In the last 12 months what referrals were made for your prenatal patients?

	Yes ▼	No ▼
Nutrition	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Dental Health	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Childbirth Preparation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Genetic Screening	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
WIC	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Baby Love	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂
Social Work	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂

14. In your estimation, what percent of patients experience problems with their gums during pregnancy?

%

15. In what trimester are you mostly likely to recommend patients for dental treatment?

- ☐ ₁ First
- ☐ ₂ Second
- ☐ ₃ Third
- ☐ ₄ None

16. In the past month how many times did you refer a prenatal patient to a dental office or clinic for cavities?

- ☐ ₁ None
- ☐ ₂ 1-5 times
- ☐ ₃ 6-10 times
- ☐ ₄ 11-20 times
- ☐ ₅ More than 20 times

17. In the past month how many times did you refer a prenatal patient to a dental office or clinic for gum disease?

- ☐ ₁ None
- ☐ ₂ 1-5 times
- ☐ ₃ 6-10 times
- ☐ ₄ 11-20 times
- ☐ ₅ More than 20 times

18. Do you provide in-office oral health counseling such as good oral health habits?

- ☐ ₁ Yes
- ☐ ₂ No

**19. What oral health materials do you have in your office to use for patient education?
(CHECK ALL THAT APPLY)**

- ☐ ₁ None
- ☐ ₂ Printed educational material
- ☐ ₃ Posters
- ☐ ₄ Tooth brushes/Dental floss
- ☐ ₅ Videos
- ☐ ₆ Flip charts
- ☐ ₇ Teeth
- ☐ ₈ Pamphlet
- ☐ ₉ Other: _____

Some research reports have suggested that there is a relationship between oral health and systemic health. The following questions are intended to assess your view of this relationship.

Knowledge About Periodontal Disease And Systemic Health

20. In your estimation, what is the level of risk for adverse pregnancy outcomes associated with each of the following:

	Definite Risk ▼	Possible Risk ▼	Uncertain ▼	Probably No Risk ▼	Definitely No Risk ▼
Maternal Smoking	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Second Hand Smoke	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Periodontal Disease	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Taking care of a cat	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Bacterial Vaginosis	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Multiple Gestation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Family history of birth defect	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Strenuous Exercising	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Work outside the home	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Previous Preterm Delivery	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Maternal age of 35	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

**21. Which of the following do you believe to be associated with the etiology of gum disease?
(CHECK ALL THAT APPLY)**

- ☐₁ Excess sugar consumption
- ☐₂ Bacteria
- ☐₃ Tooth decay
- ☐₄ Aging
- ☐₅ Genetics
- ☐₆ Child bearing
- ☐₇ Smoking

22. Which of the following describes gingivitis? (CHECK ALL THAT APPLY)

- ☐ ₁ Tooth decay
- ☐ ₂ A potentially reversible infection of the gums
- ☐ ₃ A reversible redness and or swelling of the gums
- ☐ ₄ Lesions on the tongue

23. Which of the following describes periodontitis? (CHECK ALL THAT APPLY)

- ☐ ₁ Tooth decay
- ☐ ₂ A potentially reversible infection of the gums
- ☐ ₃ A reversible redness and or swelling of the gums
- ☐ ₄ Lesions on the tongue

24. Which condition is worse?

- ☐ ₁ Periodontitis
- ☐ ₂ Gingivitis

25. Which of the following is a first sign of periodontal disease? (MAKE ONE CHOICE)

- ☐ ₁ Bad breath
- ☐ ₂ Bleeding gums
- ☐ ₃ Cavities (holes in teeth)
- ☐ ₄ Teeth that move around (are mobile)

26. In which trimester is it safe for a pregnant patient to have the following dental procedures performed? (CHECK ALL THAT APPLY)

		Not Safe		Safe During...	
	None (Not safe at all during pregnancy) ▼	1 st Trimester ▼	2 nd Trimester ▼	3 rd Trimester ▼	
Dental Examination	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Periodontal Probing	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Periodontal Scaling	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Tooth Polishing	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Dental X-Rays	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Oral Cancer Examination	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Tooth Whitening	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	
Cavity Filled	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	

Your Opinions About Periodontal Disease And Systemic Health

27. Please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Agree ▼	Agree ▼	Disagree ▼	Strongly Disagree ▼	Don't Know ▼
I am trained to provide an oral exam.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
I am adequately trained to provide an oral health diagnosis to patients.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
I am comfortable looking in a patient's mouth and determining if they have gum disease.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
I do not have enough time with each patient to provide an oral health exam.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
I know dentists who I can refer patients to if needed.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
My knowledge about periodontal disease is current.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
I am knowledgeable regarding the studies linking periodontal disease to adverse pregnancy outcomes.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
I need additional information about periodontal disease and its impact on adverse pregnancy outcomes.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Good periodontal health is vital to a Normal delivery.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
My patients are knowledgeable about the importance of good oral health during their pregnancy.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
My patients are willing to seek dental care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

My patients practice good oral health care.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
If a patient brushes and flosses her teeth regularly she will reduce her chances of having periodontal disease.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Nurse practitioners, physician assistants and nurse midwives should be taught about periodontal health.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Nurse practitioners, physician assistants and nurse midwives should be taught how to perform a cursory examination to determine health or disease.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Nurse practitioners, physician assistants and nurse midwives should perform periodontal examinations to determine if a patient needs to be referred to a dentist.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Nurse practitioners, physician assistants and nurse midwives are qualified to perform a periodontal examination to determine if a patient needs to be referred to a dentist.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Nurse practitioners, physician assistants and nurse midwives need to collaborate with dental professionals to reduce a patient's risk of having an adverse pregnancy outcome.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

28. Please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Agree ▼	Agree ▼	Disagree ▼	Strongly Disagree ▼	Don't Know ▼
I am comfortable referring patients with dental problems.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
Periodontal disease is a risk factor for adverse pregnancy outcomes.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
In recent years, an association has been made between periodontal disease and adverse pregnancy outcomes.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
If a patient has periodontal disease she is more likely to have adverse pregnancy outcomes than a patient with healthy gums.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
The research is inconclusive regarding the relationship between periodontal disease and adverse pregnancy outcomes.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Nurse Practitioner, Physician Assistant And Nurse Midwife Education

29. Did your (Nurse Practitioner, Physician Assistant, Nurse Midwife) program address dental health in the curriculum?

☐₁ Yes

☐₂ No (No Skip to Question 33)

30. If yes, how many hours of material regarding oral health/periodontal health were covered in the curriculum?

☐₁ None

☐₂ Less than 1Hour

☐₃ More than 1Hour and Less than 3 Hours

☐₄ More than 3 Hours and Less than 5 Hours

☐₅ More than 5 Hours

31. Did you have any clinical requirements regarding assessments of the gums?

☐₁ Yes

☐₂ No

32. Did you receive any clinical experiences (observation, providing patient care, etc) with dentists or dental hygienists?

☐₁ Yes

☐₂ No

33. Regarding the educational program you attended to become a Nurse Practitioner, Physician Assistant, Nurse Midwife, how was the education in teaching you about oral health?

☐₁ Very good

☐₂ Good

☐₃ Fair

☐₄ Poor

☐₅ Very Poor

34. Year of graduation from Nurse Practitioner, Physician Assistant, Nurse Midwife program?

--	--	--	--

Continuing Education In Oral/ Periodontal Health

35. In the past year what resources have you used to learn about oral/ periodontal health?

- ☐ ₁ None
- ☐ ₂ Professional journals (specify) _____
- ☐ ₃ Internet sites (specify) _____
- ☐ ₄ Corporate manufacturers' websites
- ☐ ₅ Text books
- ☐ ₆ Continuing Education/Professional meetings
- ☐ ₇ Other (please explain) _____

36. What is the average number of hours of continuing education you receive per year?

- ☐ ₁ Less than 3 hours
- ☐ ₂ 4-6 hours
- ☐ ₃ 7-9 hours
- ☐ ₄ 10-12 hours
- ☐ ₅ More than 12 hours

37. When was the last time you attended a continuing education course on oral /periodontal health?

- ☐ ₁ Within the past year
- ☐ ₂ During the past 2-5 years
- ☐ ₃ More than 5 years ago
- ☐ ₄ Never
- ☐ ₅ Have yet to attend CE (Recent Graduate)

**38. Are you interested in attending continuing education courses on oral health in the future?
(CHECK ONLY ONE)**

- ☐ ₁ Yes
- ☐ ₂ No
- ☐ ₃ Maybe

**39. From the list below choose your preferred approaches to continuing education.
(CHECK ALL THAT APPLY)**

- ☐ ₁ Handout/booklet with self test
- ☐ ₂ Continuing education journals
- ☐ ₃ Audiovisual slide or videotape
- ☐ ₄ Satellite telecommunications program
viewed at medical centers or taped for future viewing
- ☐ ₅ Lectures
- ☐ ₆ Clinical demonstrations course
- ☐ ₇ Study clubs
- ☐ ₈ Computer-based programs, e.g. CD-rom
- ☐ ₉ Conference call with expert in the field
- ☐ ₁₀ Other (specify) _____

Demographics

40. When was the last time you received dental care from a dentist or dental hygienist?

- ☐ ₁ Within the last six months
- ☐ ₂ 6 months- 1 year ago
- ☐ ₃ 1-2 years ago
- ☐ ₄ 2 or more years ago
- ☐ ₅ Never

41. When did you last have an examination to assess the health of your gums?

- ☐ ₁ Within the last six months
- ☐ ₂ 6 months- 1 year
- ☐ ₃ 1-2 years ago
- ☐ ₄ 2 or more years ago
- ☐ ₅ Never

42. Have you ever been told you have periodontal disease?

- ☐ ₁ Yes
- ☐ ₂ No
- ☐ ₃ Maybe

43. How would you rate your oral health?

☐ ₁ Excellent

☐ ₂ Good

☐ ₃ Fair

☐ ₄ Poor

☐ ₅ Very Poor

44. Highest degree you have received?

☐ ₁ Bachelors in Nursing

☐ ₂ Masters in Nursing

☐ ₃ Physician Assistant

☐ ₄ Masters in Other

☐ ₅ Other (specify) _____

45. Is there a dental school affiliated with the University or College that you attended for your Nurse Practitioner, Physician Assistant, Nurse Midwife program?

☐ ₁ Yes

☐ ₂ No

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